Investigating and Expanding Learning across Activity System Boundaries in Improved Cook Stove Innovation Diffusion and Adoption in Malawi

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by

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ABSTRACT

This study investigates and expands learning within and between activity systems working with Improved Cook Stoves (hereafter ICS) in Malawi. The study focuses on how existing learning interactions among ICS actors can be expanded using expansive learning processes, mobilised through Boundary Crossing Change Laboratories (BCCL) to potentially inform more sustained uptake and utilisation of the ICS technology. The ICS, as a socio-technical innovation, seeks to respond to climate change mitigation and adaptation efforts in the country. However, sustained uptake and utilisation has been problematic.

The study is located in the field of Environmental Education, with emphasis on the diffusion and adoption of socio-technical innovations in the context of ICS technology. The study addresses societal environmental health risks faced by people using traditional biomass fuels indoors on open fires, commonly referred to as Three Stone Fire (hereafter TSF) through formative intervention supported by Developmental Work Research (hereafter DWR) or Expansive Learning.

The study was conducted in three climate change hotspot districts in Malawi: Balaka, Dedza and Mzimba. The case studies are in each of the three administrative regions of the country. Chapita Village case study is in Balaka district, in the Southern region; Waziloya Makwakwa Village is in Mzimba district in the Northern region; and Chilije Village in Dedza district in the Central region. In order to engage the potential for transformation in study areas, I divided the study into two phases. The first phase involved collection of ethnographic data to more deeply understand the context of the problem including existing learning approaches. This informed the second phase, which focused on expansive learning processes in the Chapita and Waziloya Makwakwa case studies. The study used a formative intervention approach, which focused on supporting the actors to manage the challenges they were facing and work out the problematic situations in their joint activity. The study employed a qualitative intensive research design because it aimed at in-depth understanding of uptake and utilisation of ICS. This was an important foundation for improving the existing situations through co-creating solutions with research participants. With this generative and action-oriented approach, the study employed a multiple embedded case study design. CHAT and Critical Realism were the two main theories that I employed as they resonated with the transformative interest of the study through focusing on learning as an emancipatory process with potential for transformation of human practices. In addition, I used the methodological theory of Expansive Learning from CHAT to guide the expansive learning processes. With the critical realist framing of the study, I employed a critical realist analytical framework, and used inductive, abductive and retroductive analyses.

The major findings of the study indicate that broadly, uptake and utilisation of ICS is problematic, hence unsustained. The findings indicate that the majority of end-users in Chapita and Chilije case studies switched between TSF and ICS, or abandoned the ICS, which was not the case in Waziloya Makwakwa case study. The underlying causal mechanisms that appear to explain and influence end-users' actions in all the case studies were the search for convenience during the cooking activity. Further, findings revealed that learning interactions among activity systems were unidirectional which provides evidence for top-down approaches prevalent in cook stove dissemination. The findings also indicated that most of the learning taking place was informative, not transformative. It was also inadequate, particularly for end-users. A causal mechanism that appears to shape how actors are learning ICS technology is poverty, which results in over-reliance on donor-driven projects. Findings also reveal that contradictions in the learning, uptake and utilisation of ICS influence the profile of uptake and utilisation of ICSs. Further, the change-oriented learning processes, as carried out in the Chapita and Waziloya Makwakwa case studies, have shown their potential in expanding learning interactions among ICS actors, evoking and supporting their transformative agency and enhancing their reflexivity. These processes are crucial in development and sustaining learning and change in the uptake and utilisation of ICS innovation.

The main contribution of the study is methodological. It contributes broadly to diffusion and adoption of socio-technical innovations through change-oriented expansive learning processes. The study generated an Innovative Extension and Communicative Methodology, which foregrounds interaction and learning and links the s*ocio-technical innovation intention* and s*ocio-technical innovation uptake and utilisation* that potentially informs the dissemination and implementation of ICS projects. Further, the study contributes to community education by mobilising communities to address contradictions, absences, or ills in the society via change-oriented learning processes. The societal ills facing the case study sites and the areas around them, caused by climate change and variability and deforestation exacerbate the lives of rural women who are afflicted by conditions of poverty. The study contributes to global and local efforts and initiatives to address environmental health risks faced by people using traditional biomass fuels indoors on TSF and climate change mitigation and adaptation.

This study has found out that *putting the agency of the end-user in the centre in socio-technical transitions through context-based problem resolution and rigorous deliberate[1] mediated processes of participation and learning, which allows multivoicedness and takes power relations into account, catalyses transformative agency, reflexivity, collaboration and learning capacity of ICS actors for sustained uptake and utilisation of the ICS socio-technical innovation.*

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[1] Deliberate: conscious, intentional, careful and unhurried facilitation of learning processes

DECLARATION

I declare that this thesis is my own work and that all other sources used or quoted have been fully acknowledged and referenced. It is being submitted for the degree of Doctor of Philosophy (Environmental Education) at Rhodes University, and has not been submitted for a degree or examination at any other university.

Experencia Madalitso Jalasi

Signature……………………………….

February 2018

ACKNOWLEDGEMENTS

DEDICATION

I dedicate this thesis to my daughters, Chancy and Charlotte.

NOTE ON NAMES:

The work acknowledged as Chisoni (2014); Chisoni (2015); Chisoni (2016) is the work of the author of this thesis. Chisoni is the author's ex-husband surname. The work was carried out before changing her surname to JALASI towards the end of 2016.

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ACRONYMS AND ABBREVIATIONS

BARREM	Barrier Removal to Renewable Energy in Malawi
BCCLW	Boundary Crossing Change Laboratory Workshop
CADECOM	Catholic Development Commission in Malawi.
CCC	Cleaner Cooking Camp
CCT	Controlled Cooking Tests
CHAT	Cultural Historical Activity Theory
CR	Critical Realism
DISCOVER	Developing Innovative Solutions with Communities to Overcome Vulnerability through Enhanced Resilience
DoEA	Department of Energy Affairs
DWR	Developmental Work Research
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoM	Government of Malawi
ICS	Improved Cook Stove
MBAULA	Movement for Bio-Energy Advocacy Utilization Learning and Action
NCSSC	National Cook Stove Steering Committee
NGO	Non-Governmental Organization
NSREP	National Sustainable and Renewable Energy Program
PAESP	Promotion of Alternative Energy Sources Project
PRA	Participatory Rural Appraisal
ProBec	Program for Biomass Energy Conservation
RRA	Rapid Rural Appraisal
SEMU	Sustainable Energy Management Unit
TAP	Transformative Agency Pathway
TSF	Three Stone Fire
UNDP-UNEP-PEI	United Nations Development Program-United Nations Environment Program-Poverty Environment Initiative,
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency International Development
ZPD	Zone of Proximal Development
GHG	Greenhouse Gas

CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 Why does research on Improved Cook Stove matter?

Because energy plays such a vital role in our lives today, I hope that these statistics will not only inform but also help policymakers and others to make wise decisions so that energy is produced and consumed in a secure, affordable, efficient, and sustainable manner.(Birol[2], 2017, in International Energy Agency (IEA) 2017 p. 3 (foreword).

Significant facts and statistics on the use of biomass on open fires and its impacts on environment, health, socio-economic and sustainable development, including longstanding challenges in Improved Cook Stove (ICS) interventions globally, dating back from 1980s, provide the impetus for engaging in ICS diffusion and adoption research with an emancipatory and transformative agenda.

According to the World Health Organisation (WHO, 2016):

- ***Globally,*** around 3 billion people cook and heat their homes using open fires and simple stoves burning biomass (wood, animal dung and crop waste) and coal.
- "Over 4 million people die prematurely from illness attributable to household air pollution from cooking with solid fuels" (unpaged).
- More than 50% of premature deaths due to pneumonia among children under five are caused by the particulate matter (soot) inhaled from household air pollution.
- "3.8 million premature deaths annually are due to non-communicable diseases including stroke, ischaemic heart disease, chronic obstructive pulmonary disease and lung cancer, attributed to exposure to household air pollution" (unpaged).
- Fuel gathering consumes considerable time for women and children, limiting other productive activities (e.g. income generation) and taking children away from school. In less secure environments, women and children maybe at risk of injury and violence during fuel gathering" (unpaged).
- Black carbon (sooty particles) and methane emitted by inefficient stove combustion are powerful climate change pollutants.
- "The use of polluting fuels also poses a major burden on sustainable development" (unpaged).

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[2] Dr. Fatih Birol is the Executive Director of International Energy Agency.

- The regions primarily using solid fuels as their main cooking fuel include Africa, Americas, Eastern Mediterranean, Europe, South East Asia, and Western Pacific (especially, low and middle-income countries).
- **Sub-Saharan Africa** is among the regions with the highest populations using solid fuels as main cooking fuel (World Health Organisation (WHO), 2012).
- Biomass cooking is among the contributing factors of forest degradation and localised deforestation (Energy Sector Management Assistance Programme [ESMAP], 2015, p. 25).
- "Fuel wood in sub Saharan African countries is consumed up to 200% times more than the annual growth rates of the trees" (Conserve Energy Future (CEF), n.d. unpaged). "This is causing deforestation, lack of timber resources and loss of habitat for the species living in it" (Ibid, unpaged).
- Cooking firewood scarcity is increasing in parts of Africa and Asia (ESMAP, 2015).
- **Malawi** is one of the countries in Sub-Saharan Africa with the highest percentage of the population (91.4%) relying predominantly on firewood for cooking in both rural and urban areas with 51.2% of the population in the urban areas and 98.3% in the rural areas (Sepp, 2014 and United Nation Foundations [UNF], 2016). According to UNF (2016),
  - ➢ 97% of the population uses solid fuels for cooking.
  - ➢ More than 95% of urban population use solid fuels.[3]
  - ➢ More than 95% of rural population use solid fuels.
  - ➢ Household air pollution affects 3 588 207 households.
  - ➢ Household air pollution adversely affects 15 429 289 people (about 99%) of the population.
  - ➢ About 13 250 people die per year from household air pollution.
  - ➢ About 5 852 children die per year from household air pollution.
- One major environmental problem is deforestation (UNF, 2016). The deforestation rate is the highest in Southern Africa at 2.8% per year (Nkhonjera, Hameer & Kosamu, 2013).
- Fuel wood is becoming scarce (UNF, 2016).

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[3] Notice the difference in percentages between firewood and solid fuels in urban and rural areas. Solid fuels also include charcoal.

One of the main technological solutions to help mitigate the negative impacts associated with biomass cooking and adapt to fuel wood shortage and scarcity is the ICS (ESMAP, 2015 and Sepp, 2014). This is also a socio-technical innovation for climate change adaptation and mitigation.

- A variety of ICSs are implemented in the developing world. For example, Anagi cook stove in Sri Lanka; simple efficient wood cook stoves distributed by the United Nations programmes in refugee camps throughout Africa; metal insulator-lined "Thai bucket" Cookstove; ceramic Jiko and Jambar stoves in East and West Africa; the New Lao Stove in the Mekong region; the Anglo Supra in Indonesia; Ethiopia Mirt Cookstoves; China Efficient Coal Chimney Cookstoves; Uganda Rocket Lorena; Mexico Patsari; Guatemala Onil Cookstove; Awamu stove in Uganda; Belonio rice husk stoves in Philippines and Indonesia; Biolite and Oorja in India and the Phillips, chulhas in South Asia; vented biomass and coal cookstoves in China; planchas in Central America; a range of chimney mud cookstoves in Africa (ESMAP, 2015), and portable Chitetezo Mbaula in Malawi.
- However, achieving large-scale ICS dissemination and adoption remains challenging at both institutional and technical positions (Stove*plus*, 2014 and ESMAP, 2015).
- "Of the 3 billion people who rely primarily on solid fuels, less than one-third use ICSs and even these households predominantly rely on basic ICS that have limited health and environmental benefits" (ESMAP, 2015, p.2).
- The lowest penetration and utilisation of biomass ICS is in Sub-Saharan Africa compared to other regions, except South Asia (ESMAP, 2015).
- Continued use of less efficient cooking technologies is the rule rather than the exception for nearly all improved and clean cookstove interventions (ESMAP, 2015, p. 47).
- Abandonment of ICS is a common phenomenon, both with past and current cook stove interventions, for example in India, and some parts of Africa.
- In *Malawi* about 50% of people who own the basic improved wood stoves, still utilise the less efficient Three Stone Fire (TSF) (ESMAP, 2015). This figure could be higher due to reliance on surveys using interviews rather than observations.
- The World Bank (2010) has called for substantial change in various human activities, including policy, otherwise the total number of people relying on solid fuels will remain largely unchanged by 2030 (WHO, 2016).

The voices in the stories below of women in the study reveal real-world implications of the facts and statistics above.

1.2 The plight of woman in the study

Story 1: A group of women from Phalombe district narrate firewood scarcity and sexual harassment

> *Participant 1: Firewood is further. In the past, we used to collect near, but these days you have to start-off to the mountain at around 1 am at night.* (Contextual Profile Group interview, Phalombe district) (Hereafter CP GP interview, PH)[4]

> *Participant 3: There is a big problem (with firewood). … we are cooking with maize stalks but the mountain is near. The problem is that you have to climb high on top of the mountain to find firewood.* (CP GP interview, PH)

> *Participant 6: And for us women to get at the top… (It's difficult).* (CP GP interview, PH)

> *Participant 4: Like some of us are old, and to climb at to the top…* (CP GP interview, PH)

> *Participant 6: What time would you come down?* (CP GP interview, PH)

> *Participant 4: And you come downhill sliding with the buttocks with a firewood bundle on the head. Sometimes you push the bundle to roll downhill, and when you get down you have to look for it … The mountain is near but the firewood is further because many people are relying on fuelwood business.* (CP GP interview, PH)

> *Participant 1: … the problem is that we do not have any source of livelihood because we have financial problems as we indicated. So what is happening is that even us women we are cutting down standing trees, and men are burning charcoal, to find something to support your family. So now, the firewood is very much further. When you leave around 1 am., you may be back around 3 pm.* (CP GP interview, PH)

> *Participant 3: And sometimes when you meet those cruel Forestry Officers, they whip you … They whip you hard that you get out of the forest unwell. Sometimes when you are unfortunate, they gang rape you.* (CP GP interview, PH)

> *Participant 2: Yes, they all rape you.* (CP GP interview, PH)

> *Participant 3: Instead of killing you.* (CP GP interview, PH)

> *Participant 6: Some other time it happened but we managed to escape. A friend fell and we went back to fetch her. We had to run, and we could not believe we managed to escape. We spent many days without going back (to fetch firewood).* (CP GP interview, PH)

Story 2: A woman from Balaka narrates how river flooding provides firewood and how firewood scarcity coping strategies are taking away land for farming

> *End-user: Here as you can see, we hunt for firewood in these small bushes, sometimes we go to Chimwalire River, when the river floods, it fells some trees from the upper side and banks them at the lower side. And we rely on that, we go into the river and get some firewood. Sometimes you have to rely on planted trees such as blue gum … We don't have a natural forest here as you can see, we have to leave a small portion of the garden so that trees can grow and we get firewood from there. Otherwise, for those who do not have a portion, rely on the flooding Chimwalire River, but the firewood you get there is not good anyway. … We have firewood problems.* (Contextual Profile interview # Balaka 1)

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4 See Section 3.8.2 and Table 3.6 for full explanation for the index coding data sources

These women are among the millions of women in Malawi, the billions of women in Sub-Saharan Africa and globally in need of the emancipation and transformation that can result from ICS practice.

1.3 Researcher's motivation

My motivation for doing this study is underpinned by a quest for answers. I grew up as an inquisitive, observant and curious child. My father used to say it was a mistake I was born a girl. This is because these attributes were mostly associated with boys and men when and where I grew up. The same attributes led me to study Child Language Acquisition for my Master's degree and a PhD study in Environmental Education. My education background is in Language Education and Linguistics. During my Master's, as I was doing a course in Psycholinguistics, I often wondered how a child would progress from uttering a word incorrectly to uttering it correctly within few days. The development, which was happening without me noticing how the changes were taking place, led me to do a dissertation in Child Language Acquisition. My curiosity and fascination grew when I conducted a mini project for the course with one child. I completed my MA in Applied Linguistics with a dissertation on "The First Language Comprehension and Production of Directives in Chichewa" of four children between the ages of 4-5 years. People around me had always wondered how I ended up with a dissertation in child language, when all along my interests were in translation theory and practice.

The same quest for answers motivated the present study as introduced in Section 1.1 above. In my earlier fieldwork activities between 1998 and 2003, I made a general observation that developmental projects in some parts of Malawi that were seemingly beneficial to the communities, were not taken up in a sustained manner a few years after implementation. As an undergraduate, I worked as a Research Assistant with the Creative Centre for Community Mobilisation. Our approach was 'Theatre for Development', used to mobilise communities to address problems they were facing in different parts of the country. After my graduate studies, I worked as a Language Specialist at the Centre for Language Studies, under the University of Malawi. Part of my work involved interpretation, translation and teaching local language to expatriates. Another opportunity to travel in rural communities occurred during this time. I visited various communities in a few districts when I worked as an interpreter for a PhD student from Michigan State University who was doing a study in fishing management. During these field visits, I came across various defunct projects. My curiosity grew because I observed the same phenomena in different parts of the country, in different projects, with different communities, facing different problems. I wondered what developmental projects had in common, that led to this problem. During my visits to some communities in Tanzania, Kilimanjaro region, I made similar observations. My curiosity matured, and in the quest to find answers, I conducted a study with coffee farmers at the Kilimanjaro Native Cooperative Union. The study sought to understand the farmers' perceptions of Fair Trade premium (FT premium) as a socio-

economic development tool. This satisfied part of my curiosity. This is because one of the major findings of the study was that, as much as farmers benefited from the FT premium through implementation of environmental and socio-economic developmental activities in the communities, they were not engaged in decision-making regarding the type of activity in which to invest the FT premium. They wanted the FT premium to be directed towards their personal economic empowerment, so that they could re-invest in coffee cultivation and support their families.

Going back home, I realised that it was possible to find answers to the questions I had about defunct developmental projects. Whenever I had an opportunity to chat with community members, especially in my home village Balaka, the quest for answers grew. I remember talking to my mother about a kindergarten project. She told me that my three-year-old niece had started counting and reading alphabet letters at kindergarten, but she had regressed because the project was no longer running. Hence, my question was why it stopped. My mother was not able to provide an explanation. Once, on my way to visit my sister in Mulanje, I stopped at a certain place where they were selling fuel briquettes to purchase some for my sister. They told me the project was no longer running. I did not get an explanation for why it had stopped either. The only thing I gathered was that they used to benefit considerably when the project was running. My motivation and curiosity grew, as I really wanted to find the underlying cause, to understand why, if the projects were indeed benefiting the people, they had stopped? The more my curiosity grew, the more observant I became, and the more I came across defunct projects in different parts of the country, such as village banks, rural kindergartens, irrigation projects and fuel briquette projects.

When I received an advert for a scholarship on Capacity Building for Managing Climate Change in Malawi, I pondered what context to focus on, because numerous environmental problems needed addressing in Malawi. At last, I settled on household energy because, as a teenage girl, I grew up in Balaka where firewood was scarce and I knew that ICS projects had been implemented in the district. What I needed to understand was whether the ICS projects experienced similar issues to those indicated above. The first article that I consulted to write a concept to apply for the scholarship provided evidence that most ICS projects were defunct in Malawi, and that globally, adoption of ICS was generally problematic. I could not understand why, knowing that firewood was becoming scarce in some parts of the country, and that the ICS saves firewood, one would abandon it. During the contextual profiling that I conducted in preparation for the present study, I gathered that producers were making money and managed to construct houses, pay for their children's school fees; they narrated the empowerment the ICS business had brought to them as women, and how they managed to buy domestic animals such as goats. So why did so many people stop producing these stoves? I realised that I would be able to answer the questions

only through engaging with the people who were closely working with the technology. With a language and education background, and working as language and communication lecturer at Lilongwe University of Agriculture and Natural Resources (LUANAR), my earlier assumptions were focused on problems with communication approaches used to disseminate the technology.

I gave my scholarship application to a colleague, a doctor in the Extension Department at LUANAR, to review it. One of her comments was that, "it looks like you would want to do action research…, but I am sure you don't want to go that way". The phrase 'action research' had not appeared in my concept paper. I replied, "I do not just want to find problems; I would like to find answers to the problems once I identify them." Then she responded, then I think that is what you want, action research. I did not know much about action research or the methodological approaches I was going to use to find answers to the problems. I was clear about one thing and that was why I wanted to do the research: "to help communities find solutions to their problems".

Next, I needed to find a research approach that would help me engage more deeply with the issues around Improved Cook Stove uptake and utilisation, as well as research participants as a foundation for finding solutions to the problems experienced in their activities. I read several theories and approaches. Then I settled on Formative Intervention in order to support communities to cope with the challenging changes and work out contradictions in their various ICS activities (Sannino, Engeström & Lemos, 2016; Engeström & Sannino, 2011) and on Developmental Work Research (DWR)/Expansive Learning because it places primacy on communities as learners and on transformation and creation of culture (Engeström & Sannino, 2010). I also settled on Cultural Historical Activity Theory (CHAT) as an interventionist theory, that foregrounds change and learning that emerges from engagement with and out of contradictions.

Some people still wonder how I ended up doing a Formative Intervention study on ICS uptake and utilisation in Environmental Education. This is basically rooted in my curiosity, being inquisitive and observant about the world around us, and the quest to find answers to questions and problems affecting the majority of the population in my country and the world.

1.4 Research context

The study is located within a national programme which is working towards building capacity to manage climate change in Malawi through various mitigation and adaptation activities. It is implemented within climate change hotspots districts in the country. Hence, the present study was conducted in three climate change hotspots districts: Balaka, Dedza and Mzimba (Lilongwe University of Agriculture and Natural

Resources [LUANAR], 2013) located in each of the administrative regions as indicated in Figure 1.1. The societal ills facing the case study sites and the areas around them include floods, dry spells, erratic rains, high deforestation rates, environmental degradation and firewood scarcity, among other things. Through Boundary Crossing Change Laboratory Workshops (BCCLWs), the study brought together key actors ranging from policy makers, implementers (non-governmental organisations – NGOs), rural production groups that are predominantly women, stove promoters, stove trainers and end-users of the cook stove technology to deliberate on problematic situations around uptake and utilisation of ICS and find solutions, in order to inform more sustained uptake and utilisation of the ICS. Hence, the study takes a systemic and relational approach in dealing with challenges facing ICS practices.
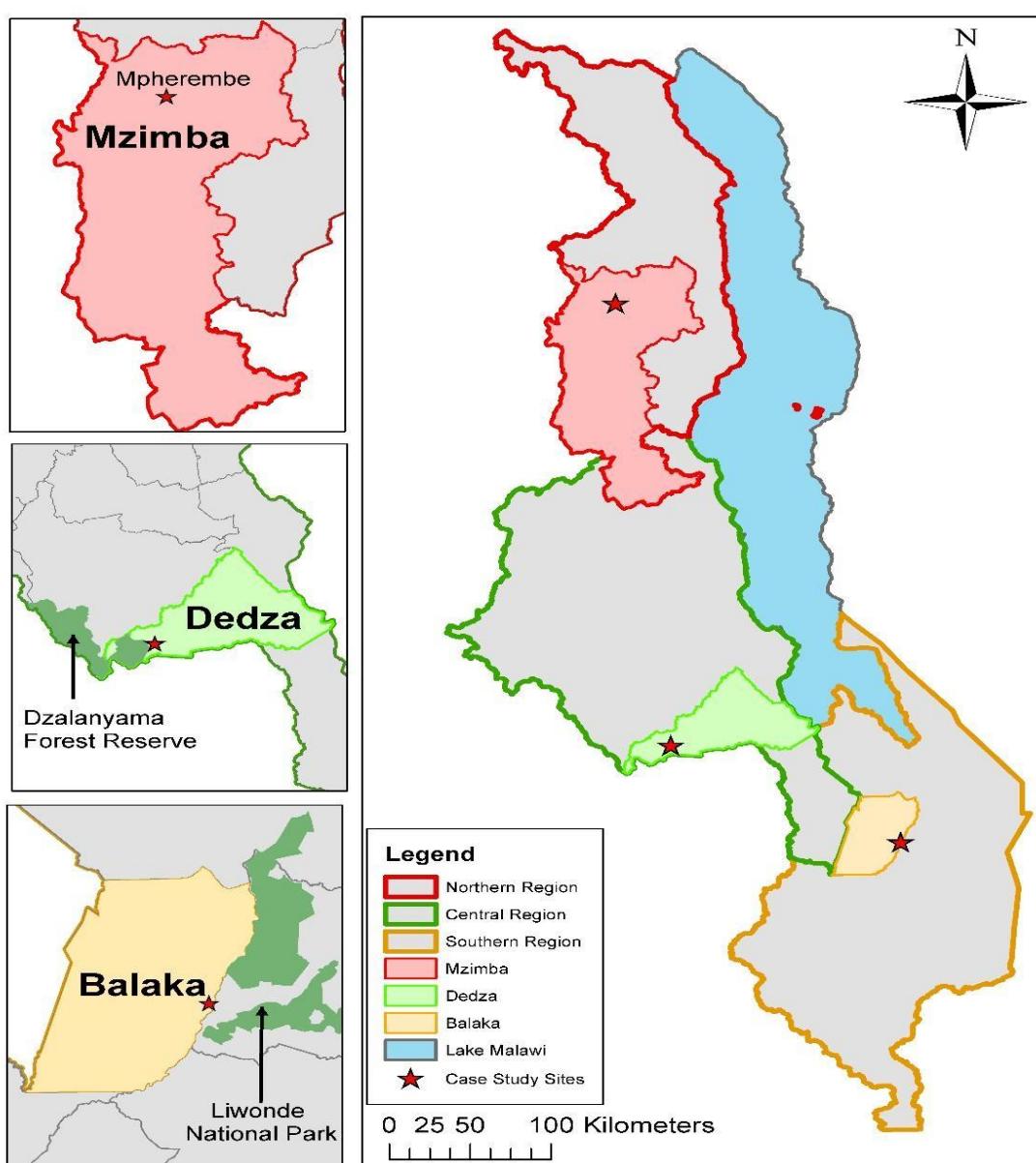
Figure 1.1: Map of Malawi and the study sites
Source: Weaver, 2018

1.4.1 Demography

Malawi is a landlocked country located in Southern Africa, within the Sub-Saharan Africa region. It is located between latitudes 9˚ 22' S and 17˚ 3' S and longitudes 33˚ 40' E and 35˚ 55' E. Malawi is about 900 km long and 80-161 km wide. It has a total area of 118 484 km² of which 80% is land and 20% is covered by water, which is mainly comprised of Lake Malawi. The country is divided into three administrative regions, Northern Region, Central Region and Southern Region (see Figure 1.1).

Malawi is one of the poorest countries in the world with Gross Domestic Product (GDP) per capita of 481.50 US dollars in 2016 (Trading Economics, 2017). According to the World Bank (2015), in 2010, about 76% of the population lived below the international poverty line of $1.25 per day, and approximately 90% lived on less than $2.00 a day. The poorest of the population are women (Malawi. Ministry of Finance, Economic Planning and Development [MFEPD], 2016). The country's economy is predominantly agriculture accounting for about 39% of GDP and 90% of export revenues (Trading Economics, 2017). More than 85% of rural households derive their livelihoods from rain-fed agriculture (Malawi. Ministry of Agriculture and Food Security [MAFS], 2012, p. 12). Biomass also makes significant contributions to the national economy (Kambewa & Chiwawula, 2010; Kamanga, Vedeld, & Sjaastad, 2009). According to Kambewa and Chiwaula (2010), the value of charcoal produced in Malawi is estimated at US$57 million while firewood is estimated at US$117.2 million (p. 6). It is estimated that the forestry sector's contribution to the country's GDP is 6.1% (ibid.). Biomass is also a source of livelihoods to many households in the country in both rural and urban areas (ibid.).

Photo 1.1: Firewood and Charcoal being transported from Dzalanyama Forest Reserve for sale in Lilongwe City (Chisoni, August 2014)

Malawi relies heavily on donor support for its budget (Ng'ambi, 2010; Kalinga & Crosby, 2001; Dionne, Kramon & Roberts, 2013). The country has over 500 NGOs, most of which are funded by international donors (Kalinga, 2012 and Dionne et al., 2013). However, most have no ties with the government and do not work closely with the communities (Kalinga & Crosby, 2001; Muula & Broadhead, 2001). The situation

culminates in prescriptive approaches shaping how NGOs implement developmental projects, in terms of type (Pensulo, 2015), duration and outcomes that satisfy objectives of the funders. Hence, it appears to encourage top-down approaches in the implementation of developmental projects. For example, the Mulanje District commissioner bemoaned how an NGO failed to listen to the need to prioritise water and sanitation as major concerns facing a community that resulted in many children dying from water-borne diseases (Pensulo, 2015). Yet the funders kept channelling the money to HIV and AIDS (ibid.). This study also found that external driven projects influenced adoption and quality of stoves produced, because of the "terms and conditions prescribed by the donors" (see Chapter 6, Section 6.3.4.3).

The main donor organisations funding the Improved Cook Stove technology intervention and NGOs, with ties to the government[5] under the National Cookstove Steering Committee (NCSSC) include Irish Aid, United States Agency for International Development (USAID), Norwegian Government (NORAD) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Numerous NGOs work with the ICS technology diffusion in the country with funding from these organisations. The following are some of the NGOs working with the government under the NCSSC: Concern Universal (presently known as United Purpose), Movement for Bio-energy Advocacy Utilisation Learning and Action (MBAULA) network, CLOMA Ltd. and Total Land Care (TLC).

Due to the levels of poverty in the country, the Government of Malawi (GoM) advocates low-cost technologies for household use including the ICS (Malawi. Ministry of Energy & Mining (MEM), 2003; Chisoni, 2016a)[6].

1.4.2 Energy situation in Malawi

Malawi is facing challenges "to meet the energy needs of the various sectors" (Gamula, Hui & Peng, 2013, p.45). "Energy supply deficiencies are common which result in interruptions to processes that require energy as an input" (Ibid.). Furthermore, the middle-income range of the population is failing to climb the energy ladder because of the high cost of electricity. The higher alternative energy sources such as gas and electricity do not reach the low-income and rural populations because they are neither available nor affordable (Brinkmann, 2005). Coupled with frequent power interruptions, the use of wood-based fuels such as charcoal is common amongst the populations that can afford electricity. As a result, 97% of the population uses solid fuels for cooking (UNF, 2016). A large number of the population (91.4%) relies on firewood for cooking (Sepp, 2014; UNF, 2016), charcoal accounts for 8%, electricity 2%, paraffin 1% and another 1% use other means such as crop residues, animal dung (Malawi. National Statistical

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[5] This is not meant to be an exhaustive list of donor organisations and NGOs working with government, the list includes only those under the NCSSC.
[6] See Appendix 1 for the paper.

Office [NSO], 2009) and other sources such as plastic bags. Both urban (51.2%) and rural (98.3%) populations use firewood for cooking (Sepp, 2014; UNF, 2016). About 88.5% of the country's energy requirements comes from biomass, 6.4% comes from petroleum, 2.8% from electricity and 2.4% from coal (Malawi. NSO, 2009). Households account for 83% of all energy consumption (ibid.). Consequently, the energy situation puts pressure on wood and forests.

Deforestation in Malawi is continuing at a high rate and firewood is becoming scarce in many parts of the country (Malinski, 2008; Birkmann, 2005; Nkhonjera et al., 2013, Kees & Feldmann, 2011). Despite ongoing debates in literature on whether wood resources for fuel is the principal cause of deforestation (ESMAP, 2015), some studies argue that causes of deforestation differ in different regions (Toulmin, 2009; Schalag & Zuzarte, 2008). For example, data from 40 African nations indicate a clear link between the rate of deforestation and the rate of fuelwood production (Schalag & Zuzarte, 2008 p. 8). Barnes, Openshaw, Smith & van der Pals (1993) remarked that pressure on wood resources for fuel has added considerable momentum to deforestation. ESMAP (2015) emphasised that biomass cooking is among the contributing factors to forest degradation and localised deforestation. In Malawi, the main driver for deforestation is the practice of turning charcoal into cooking fuel (Fiorenza, Jangda, Malcomb & Mao, 2013; Kambewa et al., 2007 in Toulim, 2009). Charcoal use has led to a 13% decline in forest cover in the past 20 years (Fiorenza et al., 2013.) Additionally, it is estimated that 15 000 hectares of forestland is cleared per year because of charcoal burning (Kambewa et al., 2007 in Toulim, 2009). This places Malawi as one of the countries with the highest annual deforestation rates in Southern Africa which is about 2.8 % per year (Malinski, 2008; Fiorenza et al., 2013; Toulim, 2009), and the tenth highest deforestation rate in Africa (Nkhonjera et al., 2013). This is considerably higher than Africa's average deforestation rate of 0.78% and the world's average deforestation rate of 0.22% (Kosamu in Nkhonjera et al., 2013, p. 69). Malawi's forestry reserves declined from 47% to 28% of the country's area in the past 25 years (Malinski, 2008). In some parts of Malawi, women fell standing trees for firewood because they cannot find firewood on the forest floor (Chisoni, 2014). One example is Mulanje Mountain (see Photo 1.2) where women fell trees for firewood and earning a livelihood (ibid.).

According to Sepp (2006), energy consumption will continue to grow despite concerns about climate change. Studies indicate that wood-based fuels will remain a major energy source in Africa for decades to come (International Energy Agency (IEA), 2010). The World Energy Outlook report of 2010 estimates that the number of wood-based biomass energy consumers in Sub-Saharan Africa will reach one billion by 2030 (ibid.). As indicated earlier, fuelwood in sub Saharan African countries is consumed more than the annual growth rates of the trees, causing deforestation (CEF, n.d. unpaged).

In Malawi, wood fuel will remain a major source of energy for decades. Figure 1.2 shows wood fuel as the major contributing energy resource to the total energy demand in the country in the years leading to 2050.
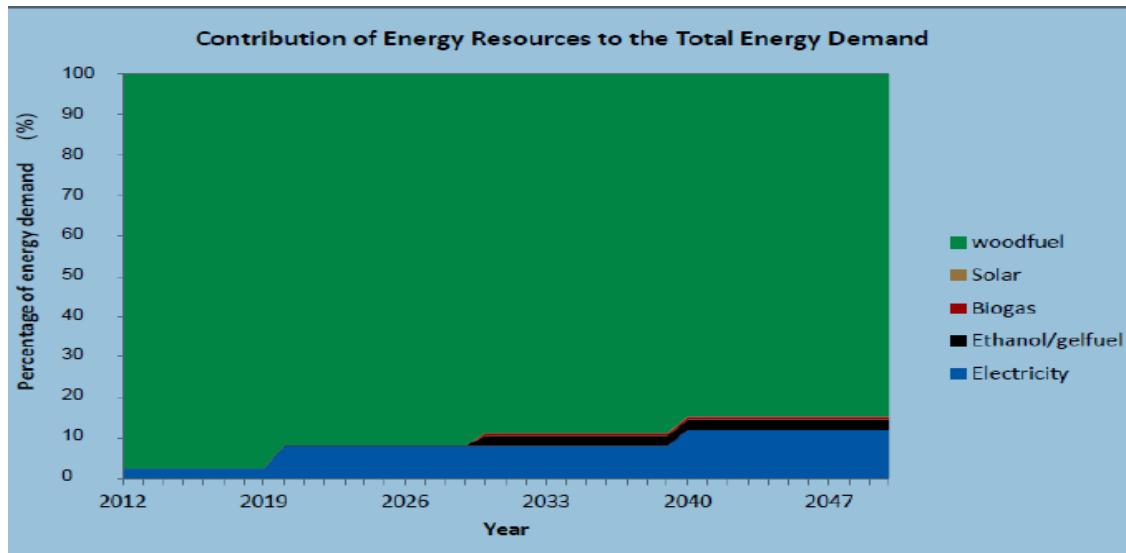
Figure 1.2: Contribution of energy resource to the energy demand (Source: Nkhonjera et al., 2013)

Loss of forests contribute to Greenhouse Gas (GHG) emissions (World Resources Institute [WRI], 1990). Forests store carbon, buffer the planet against global warming by absorbing carbon dioxide and help to stabilise the atmospheric levels of the GHG (Toulmin, 2009; Zomer, Trabucco, Bossio & Verchot, 2008). Additionally, forests regulate both local and global weather patterns by storing and releasing moisture (Toulmin, 2009; Miller & Cotter, 2013). The roots bind soils and stabilise land, preventing erosion and creating natural protective barriers against the sun and storms, wind and waves (Toulmin, 2009) which are increasing in intensity with global warming (Maluwa, Njoloma, Kassam, Phiri, & Kakota, 2013; Toulmin, 2009). Hence, forests influence climate change through physical, chemical and biological processes.

Photo 1.2: Loss of forest cover on Mulanje Mountain (Chisoni, August 2014)

The increase in loss of forests in Malawi causes environmental problems such as erosion, flash floods and river siltation (Malinski, 2008) and firewood scarcity (see Photo 1.3). Additionally, women who are

usually in charge of fuel gathering, have to cover farther distances to collect firewood (Malinski, 2008; Brinkmann, 2005) keeping them from productive economic and household activities and increasing their vulnerability (Malinski, 2008; Chisoni, 2014). In some places, such as Balaka, Mulanje, Dedza, Thyolo, Phalombe, Mzimba, and so on, some households purchase firewood; this has huge implications for household expenditure. Heltberg, Amdit, & Sekhar (2000) noted that when collection exceeds sustainable yield, forests do not have enough time to replenish because of over harvesting. Nkhonjera et al. (2013) noted that the high demand of fuelwood in Malawi cannot be covered sustainably by the available supply if the majority of households continue using the TSF (as is the case presently), which has an efficiency of 15% (Malawi. MEM, 2003) which is lower than most common ICSs promoted in the country. Common ICS types promoted in Malawi have an efficiency rate of above 30% (Malakini, Mwase, Maganga & Khonje, 2014).

Mass adoption and use of Improved Cook Stoves can therefore contribute significantly to achieving cooking energy supply sustainability in Malawi and allow regeneration of the remaining forest cover. This may eventually lead to environmental sustainability with the use of ICS technology in the country. Environmental sustainability for renewable resources implies that the rate of harvest would not exceed the rate of regeneration (Daly, 1990). It also includes using less energy (ibid.).

Photo 1.3: Firewood scarcity: windshield trees cleared around households (left) and cooking with pigeon peas stalks on TSF (right) (Chisoni, August 2014)

1.4.3 Climate Change mitigation and adaptation and Improved Cook Stoves

Climate change is one of the leading environmental challenges for present and future generations (Fiorenza et al., 2013). The magnitude of climate change effects varies in different parts of the world, however, adverse consequences affect mostly poor communities in developing countries that are least able to cope and adapt (ibid.). Climate change can lead to resource scarcities resulting in energy poverty, food insecurity, water scarcity and disease outbreaks, among others (Abeysinghe, Burton, Gao, Lemos, Masui, O'Brien & Warner, 2014). Energy poverty poses a challenge to the achievement of sustainable development; without sustainable energy, it is difficult to achieve sustainable development. Sustainable Development Goal (SDG) 7 which calls for "affordable, reliable, sustainable, and modern energy for all" (United Nations [UN], 2015, p. 21), is crucial for the achievement of a number of other SDGs, for example,

health, education, gender equality, economic growth and climate change mitigation (UN, 2016, p. 24). Hence, ensuring sustainable energy access is critical in delivering not only SDG 7, but also all the SDGs (Sustainable Energy for All (SE4All), 2016, p. 10). Without sustainable energy, development that lifts up all people while protecting the planet is simply not possible (SE4All, http://www.se4all.org/about-us).

In Malawi, the most serious climate change risks and impacts include prolonged dry spells, seasonal droughts, floods, late onset of rains, higher temperatures, delayed and shorter rainy seasons, increased intensity of rainfall and erratic rains, all of which severely affect people's livelihoods (Malawi. Ministry of Environment and Climate Change Management (MECCM), 2012; Lotz-Sisitka & Urquhart, 2013). Some of the environmental risks and hazards experienced and local climate change and variability are due to the effects of loss of forest cover (LUANAR, 2013; Nkhonjera et al., 2013). As indicated earlier, forests influence local weather patterns and regulate rainfall patterns (Toulmin, 2009; Fiorenza et al., 2013).

Smith and Haigler (2008) emphasised the importance of effective policies and projects that target the remaining forest stock, which they argued, can be achieved by implementing them in conjunction with policies influencing domestic fuel consumption. This study is concerned with reduction of rural households' fuel consumption through encouraging sustainable harvesting of fuelwood by utilising ICSs.

In addressing the impact of climate change, two terms are of major importance: adaptation and mitigation. According to Smith and Haigler (2008) "in IPCC terminology, mitigation refers solely to actions that reduce the emissions of GHGs or remove them from the atmosphere" (p.12). On the other hand, adaptation is "the process of adjustment to actual or expected climate and its effects" (Intergovernmental Panel on Climate Change (IPCC), 2012, p. 556). "In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities and in some natural systems, human intervention may facilitate adjustment to expected climate and its effects" (ibid., p. 556). This study contributes to both mitigation and adaptation efforts. ICSs reduce both GHGs and health damaging pollutants (Smith & Haigler, 2008; Musall & Kuik, 2011; Grieshop, Marshall, & Kandlikar, 2011). Additionally, by utilising ICSs, some communities around the world, including Malawi, are able to build resilience in times of fuelwood shortages.

The use of Improved Cook Stoves (ICS) as a key technological solution to help mitigate the negative environmental-health impacts associated with biomass cooking and adapt to fuel wood scarcity is well documented (Global Alliance for Clean Cookstoves [GACC] (2016); WHO, 2016; ESMAP, 2015; Sepp, 2014; Musall & Kuik, 2011; Grieshop et al., 2011; Smith & Haigler, 2008). Additionally, SDG 7 (7.3) underlines the need for "doubling the global rate of improvement in energy efficiency" in one of its objectives (United Nations, 2015, p. 21) for climate change mitigation and adaptation.

Despite a range of variations, Improved Cook Stoves (ICS) are mainly designed with the same main technical principles responsible for the climate and health benefits, among a diverse of other benefits. These include (1) improved combustion efficiency, which decreases harmful emissions; (2) improved heat transfer to the pot, which reduces fuel requirements (Kees & Feldmann, 2011; Grieshop et al., 2011). However, emissions can be reduced without necessarily reducing fuel use, for example, if combustion efficiency is improved at the expense of heat transfer efficiency (Kees & Feldmann, 2011; Grieshop et al., 2011); (3) increased ventilation, which aims to remove stove emissions from the cooking area, hence reducing exposure concentration achieved either via increased room air exchange rate or via active venting using a chimney (Grieshop et al., 2011).

According to ESMAP (2015), improved biomass cookstoves, such as the ones included in this study (see Sections 1.7.1.3 and 1.7.2.3) are categorised under improved cooking solutions. These are cooking solutions that improve however minimally, the adverse health, environmental, or economic outcomes from cooking with traditional solid fuel technologies (p. xi). There is a wide variety of ICS in terms of design and technologies ranging from user-built stoves made from local materials to mass-produced advanced combustion stoves (ESMAP, 2015).

1.4.4 Brief history of Improved Cook Stove innovation diffusion and adoption

This section provides a brief history of the progress made in household cooking activity towards addressing environmental health and socio-economic effects as a result of biomass cooking on open fires. It provides a brief history of the traditional cookstove and ICS evolution. It focuses on major challenges with the diffusion and adoption of ICS technology globally and in Malawi.

1.4.4.1 Evolution of traditional cookstoves and improved cookstoves globally

According to Kumar, Kumar and Tyagi (2013), cookstoves evolved with the invention of fire identified in archaeological excavations at Chou Kutien in China. During earlier ages, cooking, involving mainly roasting of meat, was mostly done over an open fire, with fuel arranged in a pyramid configuration for cooking. With the progress of civilisation, open fires were developed into ICS, called traditional cookstoves. The development of pots was a major catalyst for the development of other types of cookstoves. The open fire was developed into shielded-fires to balance the pot over the fire. The initial and simplest form of the shielded fire was the three stone arrangement (commonly referred to as TSF, open fire or traditional cookstove in literature). The TSF supported pots of various sizes by switching the angles. This improved cooking efficiency and reduced the scattering of fire from wind. Gradually the TSF developed into a U-shaped mud enclosure. Despite the fact that earlier innovations increased cooking efficiency to some extent, they did not address health and environmental hazards at that time due to lack

of awareness. Hence, the stoves (developed before 17th century) were called traditional cookstoves because they had very low thermal efficiency and emitted a lot of smoke. "Development of biomass based cookstoves started in India around the 1940s"(Ibid., p.267). This generation of cookstoves were called improved mud cookstoves or first generation flued (FGF) cookstoves. The FGF cookstove called Magan Chulha was developed in India in 1947. The Raju introduced the improved multi-pot mud cookstoves, meant for rural households in India. Testing of biomass cookstoves dates back as far as 1954 when Theodorovic conducted a laboratory test on biomass burning ICS in Egypt. In 1961, Singer measured the efficiency of improved multi-pot cookstove in Indonesia. This generation of stoves had a chimney to remove the smoke from the kitchen (Kumar et al., 2013, pp. 266-267).

According to Kshirsagar and Kalamkar (2014), the TSF, which is today's traditional cookstove, has remained predominant across the world until the 18th century. It remains the preferred cooking technology in rural areas of many developing countries to date including both rural and peri-urban Malawi. However, with an emergent fuelwood crisis and expanding deforestation, which is related to the structural adjustment programmes[7] catalysed by the 1970s oil crisis, ICSs started receiving attention to provide alternatives. This marked the first phase (1970-1980) of ICS development. The focus during this phase was achieving fuel savings through increased efficiencies with smoke reduction being a secondary issue. This period is marked by the beginning of ICSs in Africa at Sahel. In the second phase of ICS development (1980-1990), issues associated with the use of stoves and women's empowerment, enhancement of livelihoods and natural resource conservation gained international recognition. It is noted however, that many stove programmes executed during this phase were not very successful. The "third phase" started around 1990 and researchers' focus shifted to the consumer needs such as smoke reduction in kitchens, user's safety and *convenience* (italics my emphasis, see Section 1.7.4) in stove use, combining additional environmental issues with the previous motivation of fuel saving and women's empowerment, health and well-being. Household energy emerged again as focus in 2002 after a decade of decline. However, most programmes that mobilise the use of the stoves have resurfaced recently in what is described by international organisations as 'Least Developing Countries (LCDs)' due to environmental and health concerns associated with the use of the open TSF in addition to fuel efficiency (ibid., pp. 582-583).

In terms of diffusion and adoption of Improved Cook Stoves, a number of studies reveal that many stove programmes have failed to penetrate the markets and gain widespread use in the developing world (ESMAP, 2015; Lambe & Senyagwa, 2015; Stove*plus* & GIZ, 2014; Kshirsagar & Kalamkar, 2014;

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[7] These were fiscal parameters on size and structure of government expenditure on fuel and control over energy consumption (Cruz & Repetto, 1992) which led to strict measures to conserve energy due to high fuel prices.

Schalag & Zuzarte, 2008; Masera, Saatkamp, & Kammen, 2000; Barnes et al., 1993). Lambe and Senyagwa (2015) echoed that despite decades of financing by international donor communities, many projects aiming to scale up adoption of ICSs have failed to gain acceptance among users and often get no further than the pilot project phase (p. 4). ESMAP (2015), based on data reviewed from large regional and country programmes and a hundred key global sector participants (p. 15) in ICS, emphasised that the continued use of less efficient cooking solutions by households that adopt clean and ICSs is the rule rather than the exception for nearly all improved and clean cookstove interventions (p. 47). This phenomenon is often referred to as fuel stacking, a "strategy by which new cooking technologies and fuels are added, but even the most traditional systems are rarely abandoned" (Masera et al., 2000, p. 2084).

A number of studies reveal several barriers to stove adoption (ESMAP, 2015; Kshirsagar & Kalamkar, 2014; Rehfuess, Puzzolo, Stanistreet, Pope, & Bruce, 2014; Concern Universal Malawi, 2012; Malinski, 2008; Quadir, Mathur & Kandal, 1995; Barnes et al., 1993). The barriers are grouped into technical and quality barriers, socio-cultural and behaviour barriers, economic/financial, institutional barriers, policy barriers, information and interaction barriers and environmental barriers. The language of 'barriers' is used in these studies and literature seemingly fails to provide more nuanced understanding of the interplay of the constraints and enablers influencing the uptake, use and diffusion of ICSs. A huge gap exists between theory and practice. The language of barriers persists (ESMAP, 2015) despite a growing awareness of the "barriers" among ICS actors. Lambe and Senyagwa (2015) observed that although development actors and policy makers are increasingly aware of the importance of psychological and cultural factors in the design of effective policies, the awareness has not been reflected on or translated into practice in policy and implementation (p. 5). Similarly, Chaurey, Krithika, Palit, Rakesh and Sovacool (2012) echoed that while the challenges of energy access are not unknown, possible solutions to address them have not been deployed (p. 50). Ruiz-Mercado and Masera (2015) bemoaned how the ambition for programmes to establish a dialogue to learn what people want in a new stove and what type of stoves they want in order to ensure sustained use and displace traditional fires has been pursued by very few programmes in reality after 50 years since the development policy community stated this (p. 55).

Literature on the adoption of cook stoves in LDCs asserts that stove dissemination has suffered from top-down approaches (for example, Lambe & Senyagwa, 2015; Lambe & Attridge, 2012; Simon, 2010; Troncoso, Castillo, Masera & Merino, 2007; Barnes et al., 1993). Troncoso et al. (2007) commented critically on the patronising approach of the stove dissemination process that disregards the priorities of the users and focuses on the technical aspects of the stove technology (pp. 2799-2800). Simon (2010) echoed that decisions about innovation development, design and distribution are usually structured

around top-down mobilisation directives reflecting the objectives of funding agencies. "One group of powerful actors sets the parameters of technology innovation while recipient groups adopt (and adapt to) those technologies with varying levels of willingness and success" (ibid., p. 2014).) Barnes et al. (1993, p. 131) in their study on stoves in India note that even when the dissemination agencies have integrated efficiency and convenience in stove usage many stove programmes have suffered from the top-down structure of the programme. Lambe and Atteridge (2012) specifically added that the National Programme for Improved Cookstoves (NPIC) in India discontinued because of top-down approaches.

On the other hand, a number of studies suggest factors that can lead to successful adoption or accelerating the adoption rate of ICSs, (for example, ESMAP, 2015; Ruiz-Mercado, Masera, Zamora & Smith, 2011; Barnes et al., 1993). Barnes et al. (1993), in a review of stove programmes globally, argued that, scarcity and costliness of fuels are more effective inducements for using ICSs than subsidies (p. 120). However, they pointed out that it is difficult to generalise the characteristics of successful stove programmes because countries are different and have different contexts and cultural preferences (ibid.). This stresses the significance of identifying problems within specific contexts and communities trying to adopt ICS, and the search for locally acceptable solutions, which is the focus of the present study. ESMAP (2015) made several recommendations towards scaling up adoption of ICS to governments, donors, NGOs and the private sector. Among the recommendations, ESMAP called for the need to prioritise market-based approaches in order to maximise cooking market sustainability; provide critical public goods to accelerate sector development with particular emphasis on consumer education, quality standards and policy reform, among other things; and that the private sector should get close to the consumer in order to build product awareness (ibid., p. 10). These recommendations have been drawn from several report findings (ibid., p. 9) and some have been implemented by some countries, including Malawi, such as the use of market-based approaches (see Chapter 2). However, problems with stacking persist among communities adopting ICS in many LDC as indicated earlier. It appears that the main issue is how the intervention processes, in trying to find solutions to the challenges, fail to take a systemic and relational approach. Lambe and Atteridge (2012) echoed that there is now a growing awareness among cookstove programme implementers, donors and researchers of the importance of understanding household preferences for various cookstove parameters and how individuals "trade off" between factors (p. 8). However, as observed earlier, the awareness does not always translate into practice.

1.4.4.2 Brief history of Improved Cook Stoves in Malawi
The evolution of the Improved Cook Stoves in Malawi is poorly documented. However, from a few research participants' recollection, it appears that ICS were introduced in the country between 1970 and 1980. This was at the time ICSs received attention globally to provide alternatives due to the emergent

fuel wood crisis and expanding deforestation as indicated earlier. Evidence shows that there were ICS activities in the country in the early 1980s (French, 1986; Urmee & Gyamfi, 2014). From information gathered from one old woman during my contextual profiling in Traditional Authority (TA) Chikumbu, Mulanje district (Chisoni, 2014, substantiated by French, 1986 and Chisale, 2015), it appears that the initial ICSs in Malawi were fixed mud stoves. They were usually constructed with bricks and mud finishing. Some were multi pot (two or three) and others single pot.

The problem with the initial improved mud stoves was efficiency (Energy Studies Unit (ESU), 1984 in French, 1986). In an outdoor demonstration, the ESU's best stove saved 50% of the wood used to cook a standard meal on TSF (French, 1986, p. 534). However, in a comparative demonstration between the TSF and the mud stove in the kitchen, the mud stove only saved about 5% of the wood required to cook on the TSF (ibid.). This was because when they went to conduct demonstrations in real-life situations in the villages, they found that women were cooking indoors to protect the fire from the wind and to use the wood as efficiently as possible (not as they had assumed). As a result, they had to experiment in a kitchen set-up, contrary to the initial laboratory-like set-up demonstrations. Lambe and Senyagwa (2015) made similar observations; they commented on how implementers follow standard processes when developing and disseminating technologies in developing countries, whereby a technology is often developed in a laboratory-like setting and pilot-tested in households, while failing to focus on users (p. 5) and real-life contexts.

Since the ESU's target was to decrease deforestation, they found the results rather unsatisfactory. They estimated that installation of mud stoves in even up to 50% of the rural households would only save about 0.7% of the trees that were cut every year (French, 1986, p. 534). This appears to explain why ICS programmes from the Government of Malawi (GoM) side were silent for almost a decade, only to re-surface around the 1990s (see below). However, from my own observation and recollection when growing up, fixed brick mud stoves were available in rural areas in Malawi in the late 1980s. There were also some ICSs, such as basic sawdust stoves, common around the early 1990s. However, it is difficult to argue about the efficiency of these stoves because of lack of documentation. Nevertheless, according to ESMAP (2015), they are ICSs because they improve on traditional biomass technology (TSF) in terms of fuel savings via improved fuel efficiency (p. xii). This is because the stoves shielded fire.

ICS programmes resurfaced around the 1990s. The most notable ICS programme was the Integrated Food Security Programme, a joint project of the German Ministry of Economic Cooperation (BMZ) and European Union implemented by GTZ (now GIZ) which started piloting the promotion of (fixed mud) ICS in 1997 in Mulanje district (Malinski, 2008). It later became part of the Program for Biomass Energy

Conservation in Southern Africa (ProBEC). With assistance from ProBEC, the Integrated Food Security Programme worked in partnership with Mulanje district authorities; it developed and implemented Biomass Energy Conservation activities. Biomass Energy Conservation programmes included promotion of efficient use of biomass for cooking in order to save energy, conservation of biomass, stopping forest degradation and reducing effort spent in connection with cooking (ibid., p.8).

From 1999, ProBEC promoted a portable clay stove called *Chitetezo Mbaula*[8] (protecting stove) for households in rural areas in the country (Malinski, 2008; Chisale, 2015). Chitetezo Mbaula is a common stove promoted and implemented in many parts of the country by various institutions, including the GoM through the Department of Energy Affairs (DoEA) and the National Cook Stove Steering Committee (NCSSC) (see below), NGOs (working with GoM or independently) and private and religious organisations. It is the stove promoted in the Chapita and Chilije case studies (see Section 1.7.1.3). Groups and individual local artisans produce Chitetezo Mbaula from pottery clay.

From the available literature, it appears that the GoM paid much attention and took major steps in the promotion of ICS in the 1990s. The GoM took a number of initiatives and formulated policies to address environmental-health risks faced by people using traditional biomass fuels indoors, to contribute to reduction of GHG and depletion of forests. Some of the key policies that highlight the promotion and utilisation of ICS include the National Forest Policy (NFP) of 1996. Under section 2.3.11, GoM called for a reduction in "dependence on wood fuel as a source of energy" through developing, adapting and promoting the use of woodfuel saving devices (Malawi. Ministry of Natural Resources [MNR], 1996). The policy clearly recognises the value and importance of wood fuels, especially for the livelihoods of producers in rural areas, and explicitly promotes the idea of sustainable wood fuel production as a commercial enterprise (Malawi. Ministry of Natural Resources Energy and Environment [MNREE], 2009, p. 20). Through the National Energy Policy (NEP) 2003, GoM pledged to take a constructive role in the alleviation of global emissions and environmental degradation through provision and promotion of low-cost technologies for efficient utilisation of wood fuels (Malawi. Ministry of Energy and Mining [MEM], 2003). Another remarkable step was the formulation of the Malawi Biomass Energy Strategy 2009. Its overall objective is to ensure a sustainable supply of affordable woodfuels. The three specific objectives are to: (1) to increase the supply of sustainable woodfuels, (2) to increase the efficiency of energy use, and (3) to create the institutional capacity to manage the biomass energy sector (Malawi. MNREE, 2009, p. 105). Additionally, the National Climate Change Policy 2013 highlighted the promotion of energy efficient stoves that would use less firewood (Malawi. Ministry of Environment and Climate Change

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[8] *Mbaula* in Chichewa language means stove, but it also a network, MBAULA network (see Chapter 5.3.2.1 and list of abbreviations).

Management (MECCM) (2013, p. 20). Further, the Malawi Growth Development Strategy (MGDS) 2006-2011 identified energy as one of the key priority areas that needed attention (Malawi. Ministry of Economic Planning and Development [MEPD], 2009). Similarly, the revised MGDS 2016 highlights the promotion of environmentally friendly technologies and practices (Malawi. Ministry of Finance, Economic Planning and Development (MFEPD), 2016).

Some of the notable initiatives taken to address the environmental health risks include: the formulation of the National Sustainable and Renewable Energy Program (NSREP) in 1999 in response to the study undertaken by the DoEA which revealed problems that hindered the uptake of renewable energy technologies (RETs) (Gamula, Hui & Peng, 2013). NSREP is an umbrella programme for all renewable energy projects implemented by various donor organisations in the country and promotes renewable energy technologies in the country (Malawi. Ministry of Environment and Climate Change Management (MECCM) (2012). Another initiative was Barrier Removal to Renewable Energy in Malawi (BARREM) 2001, which aimed at removing market barriers to increase solar photovoltaic energy service delivery (Gamula et al., 2013). Furthermore, the Programme for Biomass Energy Conservation (ProBEC) 2002 promoted Biomass Energy Conservation activities from 1999 as discussed earlier, particularly also the use of clay stoves; and the Promotion of Alternative Energy Sources Project (PAESP) 2007 promoted non-traditional fuels for cooking and heating to reduce environmental degradation (Malinski, 2008).

In 2013, the then Head of State and Government, Her Excellency Dr. Joyce Banda, launched another initiative in Balaka district on briquette and energy efficient cook stove production with the target to produce two million stoves by 2020 under the national cook stove initiative (United Nations Development Programme - United Nations Environment Programme - Poverty Environment Initiative [UNDP-UNEP-PEI], 2015a). Dr. Joyce Banda, on behalf of GoM, made the commitment to the Global Alliance on Clean Cookstoves. The initiative aims to upscale energy efficient cook stoves and sustainable energy production as an environmentally sustainable option for improving energy provision (ibid.). Following this, a Cookstove Road Map Programme was developed in 2014 with the object to catalyse sustained uptake of clean and efficient cook stoves in Malawi (GoM, 2014). A National Cookstove Taskforce was formed to drive the 2020 agenda. It was "a channel for public-private alliances, and harnessed the government's potential for leadership, and the strong interest and acumen of in-country stakeholders" (GoM, 2014, p. 5). Later the National Cook Stove Taskforce graduated into a National Cook Stove Steering Committee (NCSSC), which oversees and spearheads the commitment (NCSSC Coordinator, Contextual profile, 14 August 2014). It is chaired and led by the DoEA.

Despite the availability of these initiatives and policies to support the provision and promotion of energy efficient cookstoves, challenges in the uptake and utilisation of ICS persist (GoM, 2014) particularly the abandonment of ICS, and continued use of the TSF, which forms the basis for undertaking this study (see Section 1.5). Even more, GoM is committed to address environmental health risks faced by people using traditional biomass fuels indoors through joining effort with global frameworks and initiatives.

1.4.5 Commitment for provision of improved clean solutions: Global frameworks and initiatives

Efforts to address the impacts of climate change and other global environmental problems at the international level have chiefly been through global treaties and policy frameworks (Zomer et. al., 2008; Smith & Haigler, 2008). Some of the notable ones include agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) with the Kyoto Protocol (KP). "The objective of the UNFCCC is stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UN, 1992, p. 9). UNFCCC calls for all countries to achieve greater energy efficiency and to control GHG emissions, which includes the application of new technologies on terms which make such an application economically and socially beneficial (ibid., p.6). GoM, as a signatory to the UNFCCC, is required to report on greenhouse gas emissions and other vulnerabilities. As such, it developed a Technology Needs Assessment Report in 2003 to provide an overview of the government's strategies and requirements concerning renewable energy (Hivos, n.d., unpaged). GoM is also a signatory to the United Nations Convention to Combat Desertification (UNCCD), the Clean Development Mechanism (CDM) and the United Nations Convention on Biological Diversity. GoM is a partner institution to the Partnership for Clean Indoor Air (PCIA) launched by the United States in 2002, with a mission to improve health, livelihood, and quality of life by reducing exposure to indoor air pollution, primarily among women and children from household energy use (Partnership for Clean Indoor Air [PCIA], 2017, unpaged). It is also a partner institution to the Global Alliance for Clean Cookstoves (GACC), which was launched in 2010 by the United States Department and Environmental Protection Agency. GoM made a commitment to GACC to produce and distribute 2 million ICS by 2020 as discussed earlier (see Section 1.4.4.2). The GACC is a large coalition led by UN Foundation; it mobilises support from public, private, and non-profit stakeholders to address the production, deployment and use of clean cookstoves in the developing world (ESMAP, 2015).

These frameworks not only highlight the importance of addressing energy poverty and access to energy efficient technologies, but also, and more importantly, focus on taking actions at all levels. The 2030 Agenda for Sustainable Development, for example, highlighted the need for more research in clean energy as well as energy efficiency, among other things (UN, 2015). The Sustainable Energy for All's (SE4All) Strategic Framework for Results 2016-21 advocated taking an inclusive, people-centred

approach. This implies ensuring that the voices of the energy-poor are heard and that women are full participants and beneficiaries of energy solutions (SE4All, 2016, p. 12). Additionally, the framework advocates that strategies to close the energy access gap are designed with those affected actively involved (ibid., p. 50). The framework calls for creating spaces where people can ask questions, deliberate, and explore solutions and taking systemic approaches to energy development and diffusion processes (ibid.). These frameworks therefore underpin the approaches and methodologies employed in this study, coupled with its transformative and emancipatory agenda.

1.4.6 Diffusion of innovations

Rogers (1983) defined diffusion of innovation as the process by which an innovation is communicated through certain channels over time among the members of a social system (p. 5). The messages typical in the communication are new ideas (ibid.). Therefore, an innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption (ibid., p.11). As is already clear in this study, the innovation of focus is the ICS (practice). The diffusion process is important for the present study because of the way communities trying to adopt the ICS innovation have known it from previous intervention efforts (see Sections 1.7.1.3 and 1.7.2.3). The diffusion process can help targeted communities to perceive the ICS as something useful (Troncoso et al., 2011). Rogers (1983) proposed two models for the diffusion of innovations: (1) The centralised system, which is based on a one-way flow of communication from experts (such as technical experts) to potential users; and (2) the decentralised system, in which all members of the diffusion system (such as innovation promoters and potential users) share information to reach a mutual understanding and participate in designing and implementing an innovation (p. 346). With the top-down approach prevalent in the ICS diffusion projects, as indicated earlier, it can be argued here that the centralised models appear dominant among ICS diffusion intervention projects, more so than the decentralised models. For Rogers, however, "a social system is a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (Rogers, 1983. p. 24). Hence, the centralised model diminishes the "joint" in the problem-solving process.

Usually an intervening agency judges the relative success of diffusion of an innovation by the rate of adoption, which is the number of people or households acquiring an innovation (Rogers, 2003 as cited in Troncoso, Castillo, Merino, Lazos & Masera, 2011) in a specified period (Rogers, 2003). According to Troncoso et al. (2011), the degree of use, which is an important component, is often overlooked in determining the extent of diffusion of an innovation (p. 7601). For example, Chaurey et al. (2014) commented on how energy access projects such as ICS are generally technologically-driven in design and how monitoring is done in statistical terms, that is how many devices have been disseminated or how many households have been covered (pp. 50-51). In so doing, the physical dimension of energy access

might be addressed, but, the question "is the clean energy really being used" is often missed out (ibid., p. 51). Sometimes, however, it is not a matter of overlooking, rather of conflating the 'rate of adoption' and 'use'. In conducting this study, some practitioners conflated 'the rate of adoption' and 'use'/ 'utilisation'. In this case 'use' was synonymous with 'rate of adoption'; this was judged by the number of households who had purchased or received an ICS or the number of stoves sold. To avoid this confusion, for this study I have used *"uptake"* to mean acquiring an ICS stove by means of purchasing or receiving and *"use"* to mean cooking on the stove, of course with different frequencies. The frequencies range from abandoning the stove after first use to using the stove a number of times per week, or for selected dishes, and to using it exclusively. By *"sustained"* use, I mean using the ICS exclusively for all dishes; in similar ways communities use the TSF for as long as the ICS is in functioning condition. Three stages have been identified in the literature in the adoption of ICS and fuels: acceptance, initial use, and sustained use (Ruiz-Mercado & Masera, 2015, p. 43). This study focuses on sustained use of ICS technology.

1.4.6.1 Technological Innovation Systems and Improved Cook Stove

According to Bergek, Jacobsson, Carlsson, Lindmark and Rickne (2008, p. 408) "technological innovations systems are Socio-Technical Systems (STS) that aim to promote the development, diffusion and use of a particular technology in terms of knowledge, product or both." STSs go beyond processes of technology supply to incorporate explicitly the end users of the innovation (Geels, 2004). The STS approach is important in the framing of this study because it emphasises that both developers and users influence innovation and diffusion processes and that technological change depends on some degree of social change (Atteridge, Weitz & Nilsson et al., 2013, p. 2). Technology refers to a field of knowledge, such as rural energy or specific products, such as cook stoves (Carlsson et al., as cited in Atteridge et al., 2013). This study focuses on rural household energy for cooking (and heating) as the field of knowledge and the ICS as the product. Although the ICS is also used in the urban areas, especially Chitetezo Mbaula, the study does not include urban household energy for cooking. In addition, the study focuses on the development, diffusion and use of two types of stoves, which communities in the three case studies are trying to adopt (see Sections 1.7.1.3 and 1.7.2.3).

Technological innovation systems are often defined by their structural elements including actors, rules (which may range from legislation to cultural norms to policy initiatives) and material and technical elements (Atteridge et al., 2013). However, Hekkert et al. (as cited in Atteridge et al., 2013) asserted that investigation and analysis of structural elements alone has proved insufficient for understanding determinants of change within innovation systems. In order to bridge the gap, innovation scholars call for analysis of both process/ functions and structural elements of technology diffusion concurrently (Bergek, in Atteridge et al., 2013). They contended that there are key processes necessary for the overall function

of development, diffusion and use of a particular technology (ibid.). In working with socio-cultural historical activity theory in this study, I suggest that attention also needs to be given to historical and socio-cultural factors, enhancement of reflexivity among actors and evoking and supporting transformative human agency in STS (see Chapters 3, 6, 7 and 8).

Bergek et al. (2008) proposed several process elements in a technological innovation system derived from literature on innovation and technology diffusion. The processes are concurrent in a technological innovation system and are subject to different barriers and enablers (Atteridge et al., 2013). However, Atteridge et al. (2013) summarised six process elements deemed critical to the success of ICS technology diffusion. Although the processes included in the technological innovation system framework are a result of the analysis of innovation processes from industrialised countries, Atteridge et al. (2013) contended that it is a useful framework for understanding the opportunities and barriers for change in developing countries (p. v). They used the framework to assess the health of various processes in the Indian clean cooking sector. This study however uses the framework as a guide in tracing and articulating one of the problems, which it seeks to address in the context of technological innovation systems (see Section 1.5). This study does not intend to use the framework to evaluate the weaknesses or strengths of the system, but rather to highlight the significance of the interplay between structural and process elements, which CHAT also emphasises. CHAT allows examining the interaction between structural and process elements within an activity system and interacting activity systems. Structural elements are similar to some elements in CHAT activity systems especially those shaped by rules (rules), division of labour (power relations) and material and technical elements (mediating artefacts). CHAT, goes beyond this, and gives attention to agentive factors through its focus on agents, and their interactions with others (community). CHAT's emphasis is on the interactions between these elements and a shared object of human activity (see Chapter 3). Table 1.1 below describes the key processes underpinning systems of technology development and diffusion.

Table 1.1: Key processes underpinning systems of technology development and diffusion

Process	Description
Knowledge development and diffusion	Deepening and broadening the knowledge base in the sector. Applies to different types of knowledge (e.g. scientific, applied, marketing, and '*indigenous*') built and disseminated in different ways, and coming from different sources. (Italics, my emphasis)
Setting strategies, directions and goals	The provision of incentives for actors to enter the sector and to direct their activities towards certain developments (e.g. technologies, applications, or markets)
Entrepreneurial experimentation	The actions of entrepreneurs on the supply side, exploring new technologies and applications with the aim of creating products and services that can generate revenue
Market formation	The progressive emergence or promotion of markets for the products and services being developed; different sizes and types of markets are needed at different stages of innovation
Legitimation	Building the perception of the technology and its proponents as appropriate and desirable by relevant actors within and outside the sector. Legitimacy is a matter of both social acceptance and compliance with institutions.
Resource mobilization	The mobilisation of different resources, including financial (seed and venture capital debt), competence/human resources in entrepreneurship, management and finance, and other assets such as complementary products, services, infrastructure)

(Adapted from Atteridge et al., 2013, p. 6)

As already pointed out and significant to this study, is the interplay between structural and process elements in a technological innovation system. In any system, the processes in Table 1.1 are shaped by structural features, the actors and their networks, rules, and material and technical artifacts and also by external factors such as political debates, public opinion and the economic situation (Hillman et al., in Atteridge et al., 2013, p. 5) e.g. poverty. Other wider structural factors include culture, tradition and dependence on natural resources for energy supplies in the case of Malawi. Once initiated, the processes also have a direct influence on structural features of the system, such as which actors emerge and how they interact (ibid., p. 5).

Elsewhere I have used "key actors" included in the study; these are specific to the three case studies, those interacting with and who have a direct influence on the process of diffusion and use of the ICS technology in the three case studies. However, the ICS practice in Malawi has a number of actors; only a few are captured in Table 1.2. Table 1.2 provides a list of some structural elements of the ICS technology innovation system in Malawi. The list is not meant to be exhaustive in all categories, neither are the categories for the actors. The purpose is to provide a picture of the technological innovation system.

Table 1.2: Structural elements in the ICS practice in Malawi

Element	Category
Actors	*Government:* Ministry of National Resources Energy and Environment; Ministry of Economic Planning and Development; and Ministry of Energy and Mining; Ministry of Health; Malawi Bureau of Standards; one District Commission; DoEA under MNREE, NCSSC, etc.
	Entrepreneurs: e.g. Rural production groups, small artisanal private businesses, Area 55 consulting
	Technical and research institutions: Malawi Bureau of Standards, Universities, e.g. Malawi Polytechnic, Chancellor College, Mzuzu University, etc.
	Project implementers: NGOs: e.g. Concern Universal, EnDev, Maeve, Cooperazione Internazinale, GOAL, Self Help Africa, Hestian, Christian Aid, Africare, Mulanje Mountain Conservation Trust, Mulanje Renewable Energy Agency, etc. Faith Based Organisations, e.g. Catholic Development Commission in Malawi (CADECOM), etc.
	Consortium and Partnerships: e.g. Energizing Development, Clean Cooking Camp Malawi (stove camp); Developing Innovative Solutions with Communities to Overcome Vulnerability through Enhanced Resilience, etc.
	Donor agencies: USAID, GIZ, Norwegian government, Irish Aid, etc.
	End-users: Rural and urban communities
	Financial Institutions: Conquest Capital, Microloan Foundation, Opportunity International Bank of Malawi, Malawi Union of Savings and Credit Cooperation etc.
	Networks: e.g. Movement for Bio-energy Advocacy Utilization Learning and Action network, Cooperation Network for Renewable Energy in Malawi, Renew 'N' able Malawi, etc.
	External actors: e.g. Poverty Initiative of the United Nations Development Programme and the United Nations Environment Programme, Global Alliance for Clean Cookstoves, etc.
Rules/institutions	Various polices and initiatives (see Section 1.4.4.3); National Standards on Cookstoves, under the International Organisation for Standardisation ISO/TC285-Clean cookstoves and clean cooking solutions; promotion of low-cost technologies for household use, cultural and traditional norms in the cooking and heating practices, etc.
Material and technical features	Most prevalent are low-technology ICSs produced by predominantly rural women groups, and small-medium private entrepreneurs most of them in rural areas and few in urban areas; predominantly small-scale production facilitates, mostly utilising locally sourced materials

Source: Jalasi, 2017

1.5 Problem statement

The first problem that this study seeks to address is "fuel stacking". As indicated earlier (see Section 1.4.4.1), people may acquire new cooking technologies and fuels, but will rarely abandon even the most traditional systems (Masera et al., 2000). Dissemination of ICSs in Malawi is donor-driven through government, NGOs, private and faith based organisations; it is meeting some resistance in that end users do not use the ICSs frequently or put differently, TSF has not been fully replaced (Malinski, 2008; Concern Universal, 2012). For example, studies conducted by Malinski (2008) and Concern Universal (2012), found that about 90% of households that owned TSF and ICS used TSF every day. Additionally, during the contextual profile that I carried out in preparation for this study (Chisoni, 2014), in Mulanje, Balaka,

Dedza and Phalombe districts, I observed that many households that I visited were using TSF while an ICS, also found in the household, remained idle. Some households had abandoned the ICS after first use. This was particularly the case with the portable Chitetezo Mbaula, a common stove disseminated in most parts of the country, which is almost a baseline ICS. This, however, is a common phenomenon not only in Malawi, but also among communities trying to adopt different types of ICS in most developing countries as indicated earlier (ESMAP, 2015; Rehfuess et al., 2014).

The second problem is limited technological innovation systems approaches to ICS development and diffusion. As indicated above, technological innovations development and diffusion processes require bringing into focus the interplay between structural and process/functions elements (Atteridge et al., 2013). Nevertheless, in Malawi most structural elements and key processes are overlooked (absent), or they are weak or ineffective. For instance, when it comes to actors, it seems the most important actors in ICS adoption are women who currently use the TSF and who could use ICS. Contextual profiling research for this study (Chisoni, 2014) revealed that potential stove users have mostly been in the periphery of the development and diffusion activities and efforts appear to be concentrated on producers of the technology. Similarly, some rules (or institutions) that delineate what actors can and should do and how they interact in networks and use the materials and technical elements, are weak or absent. The same applies to material and technical elements that include the physical artefacts, such as infrastructure, equipment and natural resources. For example, National Standards on Cookstoves are available, but implementation is problematic (Chaonamwene, 2016). The capacity in stove testing is weak due to limited capacity of the Malawi Bureau of Standards (MBS) in terms of equipment for testing, such as for measuring emissions, and lack of trained staff in conducting tests and experiments (ibid.). Some national policies are inadequate (GoM, 2014, p. 7) and some are absent. For example, there appears to be no specific government policies governing the operations of ICS implementers (who are mostly NGOs) on how to conduct diffusion processes in communities.

Similarly, the Improved Cook Stove industry has focused in a limited way on some process elements. For example, market formation, which deals with the progressive emergence or promotion of markets for the products and services being developed (Bergek et al., 2008). The contextual profile undertaken for this study (Chisoni, 2014) revealed problems in stove marketing. Rural distribution networks are almost non-existent or ineffective (GoM, 2014). This scenario has resulted in defunct projects; in some places, without the knowledge of the implementing institution. This has left rural production groups with no storage space and as a result, stoves are damaged. Similarly, there are limitations in knowledge development and diffusion, for example, lack of research and development on technical and design aspects of cookstoves (GoM, 2014).

Most of the structural and process elements are stated as expected outcomes in the Cookstoves Programme Road Map 2015-2017, which is the most recent policy document stipulating the 2020 GoM's vision for scaling up the uptake of ICS in the country. However, most of them have not been translated into practice. Those that have been implemented are either weak, inadequate or ineffective. The Cookstoves Programme Road Map document recognises that cookstove practice "has taken many decades with little progression" (GoM, 2014, p. 8).

The third problem is that the Improved Cook Stove industry in Malawi appears to suffer from tenuous interactions among key actors; it is fragmented, with few collaborative efforts among the actors (Chisoni, 2014; GoM, 2014). This appears to be related to the tendency to rely on top-down intervention approaches to ICS, characteristic of donor-driven initiatives. The tenuous interaction may have created little or no opportunity for learning, knowledge sharing, insights and experiences related to the new ICS technology. Hence the three problems are related. However, "successful innovation requires not only different kinds of knowledge to develop among actors (for example, among producers and users) but also a high degree of interaction between these kinds of knowledge" (Atteridge et al., 2013, p. 6). This study seeks to address this learning-knowledge sharing gap among ICS actors.

Against the background of firewood scarcity, hardships and harassment associated with fuel wood collection as described at the beginning of the thesis and the women's perpetual expressions of the firewood-saving characteristic and other benefits associated with the use of ICS, this study seeks to understand why sustained uptake and utilisation of ICS is problematic. Addressing these problems is significant in order to protect the remaining forests and reduce environmental risks and health hazards experienced in Malawi and local climate change and variability, as highlighted above and especially in foregrounding rural women's practice and experiences in the ICS space.

1.6 Research goals, research objectives and research questions

The goal of this study is to understand how actors are learning the ICS technology and how this learning can be expanded to potentially facilitate transformative agency that can shape sustained uptake and utilisation of the ICS technology.

In order to achieve the goal, the study had the following objectives:

1. To explore opportunities for expanding learning within and between activity systems by investigating existing learning interactions among ICS innovation actors, what they learn, and how they learn ICS technology.

2. To expand learning within and between activity systems through enhancing learning interactions and resolving some contradictions identified in the uptake and utilization of ICSs.

3. To identify Transformative Agency Pathways (TAPs) that may result from the Expansive Learning.

4. To develop an Innovative Extension and Communicative methodology for ICSs to guide diffusion processes and inform extension practice that can facilitate *sustained* uptake and utilization of ICS technology.

1.6.1 Research questions

The following research questions assisted me to achieve the research objectives:

1. What is the profile of uptake and utilisation of ICSs, what factors promote and hinder their uptake and utilisation?

2. What learning interactions take place among ICS innovation actors, what do the actors learn during interactions, and how do they learn ICS technology?

3. What contradictions exist in the learning, uptake and utilisation of the ICS technology?

4. How can the learning interactions within activity systems and between *key* activity systems be expanded to facilitate *sustained* uptake and utilisation of ICSs?

5. What interaction model and what methodology can be developed from the study to facilitate ICS technology *sustained* uptake and utilisation?

1.7 Case study description: Demography and evolution of Improved Cook Stove practice

This section describes the three case studies: Chapita, Waziloya Makwakwa and Chilije villages.

1.7.1 Chapita village case study

Chapita village is in Balaka district in the Southern region of Malawi (see Figure 1.1). Balaka is located at 14˚58'45.41"S latitude and 34˚57'20.7" E longitude. Chapita is under Group Village Headman (GVH) Mmanga, in Traditional Authority (TA) Nsamala, Extension Planning Area (EPA) Mpilisi. Chapita has three sub-villages: Norosani village, Asikimu village and Ngungwa village. The nearest trading centre is Mangochi turn-off, about 7-10 km from the study site. The case study was constructed with participants from Chapita village. However, the trainer and promoters were not from the village. The stove promoter stayed about 10km away from the study area and the stove trainer about 15km away. The NGO responsible for promotion of ICS project is Concern Universal, which has offices in Balaka Township about 25km from Chapita. Concern Universal has promoted the ICS project in Chapita from 2009 (see

Chapter 5, Section 5.2.1.2). The stove production group was established in 2010 by Concern Universal with expertise from GIZ. Chapita is among the oldest communities where ICS were implemented in Balaka district. By the time I commenced the study (with the contextual profile), the cookstove project was five years old and seven years old upon completion of fieldwork.

1.7.1.1 Livelihoods in Chapita village

Like the majority of rural populations in Malawi, most households in Chapita village survive on less than a dollar a day. In some extreme cases, especially during hunger periods, roughly between September and March, some families in Balaka consume one meal a day (LUANAR, 2013). Households rely on subsistence farming that relies on rain-fed agriculture. The staple crop is maize, which is used to make Malawi's staple food called *nsima*. Other crops include cotton, pigeon peas, sweet potatoes, soya beans, groundnuts and leguminous crops such as *nseula* and *khobwe.* Some families keep goats and chickens. Due to climate variability, Balaka receives erratic rains (short rain seasons, mid-season dry spells, precipitation lower than average, extreme rainfall causing severe floods and persistent heavy rains) (LUANAR, 2013). This puts pressure on household income as some crop yields are severely affected. Sometimes community members sell livestock during food shortages in order to buy maize and other food items (ibid.). Most people rely on piecework for daily survival. The type of piecework ranges from gardening activities, such as making ridges, or weeding gardens on a contractual basis or daily basis, fetching water for brick moulding, etc. A few households run small-scale businesses such as selling scones, running small grocery shops, moulding bricks and selling fish at Mangochi turn-off. It is against this background that the stove production group saw ICS as a source of livelihood.

1.7.1.2 Firewood situation in Chapita village[9]

Balaka is among the districts with the highest rate of deforestation (Bone, Parks, Hudson, Tsirinzeni & Willcock, 2017). Firewood is scarce in the district, likewise at Chapita village. The case study site has no natural forest or a community forest nearby. The main sources of firewood are small bushes around the community, fallen trees deposited at the riverbanks of Chimwalire River, and exotic trees such as blue gum. Other sources include crop residues, for example, maize cobs, pigeon peas stalks and some litter. Over the years, the community has developed coping strategies in response to firewood shortage as follows: (1) Keeping a few trees around households; (2) Allocating a piece of land within a garden and allow trees to regenerate; (3) Felling exotic trees that they planted such as blue gum trees to make firewood; (4) Leaving some shrubs to grow in the garden, then pruning the branches; and (5) Purchasing

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[9] The firewood situation is described basing on data gathered from research participants and my own observation during contextual profiling (Chisoni, 2014).

firewood, especially for those who do not have enough land to cultivate and cannot afford to spare some land for woodlot.

1.7.1.3 Concern Universal's dominant ICS project implementation model[10]

When Concern Universal entered the communities with a stove intervention project, it mobilised the community who was interested to form a stove production group. These were predominantly women groups. Then they trained the groups in stove production and stove firing through a local stove trainer that they subcontract (see Chapter 5, Section 5.2.1.4). The Field Facilitators monitor stove quality together with stove promoters whose main duties are stove promotion and selling (see Chapter 5, Section 5.2.1.3). The groups were provided with standardised production tools. A feedback mechanism was put in place to monitor quality with serial numbers that identifies stove production groups (Stove Camp, 2013) as one of the quality assurance tools, in addition to the stove production cycle which is the main quality control tool (see Chapter 6, Photo 6.2). End-users usually purchase stoves from the local production groups within the village, but are supposed to purchase the stove from the promoter (see Chapter 6, Section 6.3.3.1). On the other hand, the stove promoter purchases stoves within and outside the zone and sells them both within and outside the zone, depending on sources of supply and demand available. A zone comprises of several villages and has a production group. The production group is supposed to be located close to a good source of clay (Stove Camp, 2013, p. 6).

The type of stove promoted is Chitetezo Mbaula as indicated earlier. The stove was designed to be cheap to produce, in order to target low-income households (Malinski, 2008) in line with the goal of GoM of advocating low-cost household technologies for affordability by rural poor populations (MEM, 2003) as indicated earlier. With improved fuel efficiency, the stove reduces the amount of fuel compared to the TSF. It can save up to 60% of firewood in ideal conditions which include using the stove with dried small pieces of wood (or split) and covering the pot with a lid when cooking (Malinski, 2008, p. 9). However, it can save over 35% of firewood (Chisale, 2015, unpaged) in real-life situations. The stove uses other sources of fuel such as maize cobs. The cleaner combustion reduces emissions of smoke, hence reducing indoor air pollution, and the shielded fire reduces the risk of burns and fire accidents (Malinski, 2008, p. 9). Box 1.1 summarises the evolution of Chitetezo Mbaula as outlined by Chisale (2015).

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[10] Concern Universal used a similar model in Chapita and Chilije case studies, hence the use of plural forms referring to two different communities.

Box 1.1: Evolution of Chitetezo Mbaula

1999: A portable stove appears from the community in Mulanje district. IFSP Mulanje teams up with ProBEC for technology transfer.

2000: Chitetezo Mbaula is born with the help of ProBEC with the following dimensions:
- firebox height - 18 cm,
- small pots sits - 15cm,
- upper diameter - large pot size
- bottom diameter - small pot size
- smoke outlet/pot rest height - 1cm
- Door - 12cmx 12cm
- Replaceable door (optional)

Photo 1.4: Chitetezo Mbaula (Chisoni, June 2016b)

2002: ProBEC introduces better bonfire kiln to Malawi

2004 onwards: out of Mulanje ProBEC organises training on kiln and stove production countrywide through village-based trainers.

2006: Redesign of Chitetezo Mbaula to incorporate lessons learnt from the rocket stoves (higher, narrower, lower pot rests, smaller door). Quality control tools on production of the stove developed.

2008: ProBEC trains Concern Universal in Balaka. Concern Universal becomes the main source of Village Based Trainers after the phasing out of ProBEC and carries on training production groups in the country.

2013: Agreements on dimensions for Chitetezo Mbaula during Stove Camp. Quality control poster released (see Chapter 6, Photo 6.2). Paddle moulds reintroduced.

2015: Chitetezo Mbaula has become the most appropriate locally produced portable firewood stove in Malawi.

Source: Jalasi, 2018

1.7.2 Waziloya Makwakwa case study

Waziloya Makwakwa village is in Mzimba district in the Northern region of Malawi. Mzimba is located at 11˚54'0"S latitude and 33˚36'0"E longitude. It is under Traditional Authority Ntwalo, Extension Planning Area Mpherembe. Waziloya Makwakwa is a group village headed by a Group Village Headman Waziloya Makwakwa; it is comprised of five villages. The case study was constructed with participants from three villages including Daniel Makwakwa, Chiuzwani, and Kawanika Chisi. CADECOM implemented the cookstove project in two areas, Kapongolo and Ehlonipeni. However, the study included the Ehlonipeni area only. The nearest trading centre is Mpherembe, about 12km from the study site. CADECOM promoted the ICS project in Ehlonipeni from October 2013, under the Integrated Community Development project (see Chapter 5, Section 5.2.2.1). At the time I commenced the study (with contextual profiling), the cookstove project was 11 months old and almost three years-old upon completion of fieldwork. The project phased out eight days after the last session of follow up workshops on 30 June 2016.

1.7.2.1 Livelihoods in Waziloya Makwakwa

In Waziloya Makwakwa, households rely on subsistence farming that relies on rain-fed agriculture. Most people are not employed; however, tobacco is the main cash crop and source of income for many

households, followed by maize. Maize is also a staple food. Other crops include groundnuts, soya beans, and millet. Some households rear cattle, goats, pigs and chickens. Some households received two goats each from CADECOM distributed under the ICD project; then each household would give two goats to the next household who did not receive initially, after the goats had produced. Other community members grow vegetables in vertical gardens courtesy of CADECOM ICD project. Mzimba receives erratic rains and droughts are common, which are attributed to rampant deforestation in the district (LUANAR, 2013, p. 15). Additionally, droughts, land degradation, siltation, floods and hailstorms have affected people's livelihoods in Mpherembe EPA (ibid.).

1.7.2.2 Firewood situation in Waziloya Makwakwa

The main drivers of deforestation in the area are tobacco growing, clearing land for farming to cater for growing families, charcoal burning (common on the other side of a community mountain forest) and the use of firewood for household cooking and heating. The main source of firewood is the community mountain forest. Firewood is moderately scarce, but the distance covered for firewood collection is becoming farther, compared to some years back, because the forest is diminishing. In the past, there was no need for firewood collection trips because villagers could collect firewood near the homesteads. Today, it takes five hours on average to make one trip to fetch firewood.

1.7.2.3 CADECOM's project implementation model

When CADECOM entered the study site, they formed clubs in each village. Each club was formed to include a mixture of 20 of the most vulnerable persons from the community, chosen by community members. Some villages had more than one club because they had more than the required number per club. The areas of vulnerability of the members within in the clubs included HIV and AIDS infected or affected people (such as those who are taking care of a sick person), those who are taking care of orphans, orphans, the old, the neediest, widows and widowers. This was done to make sure that the vulnerable persons should benefit from all the interventions within the ICD project. The ICD project had three components: food security, water and sanitation, and natural resource management. The members of the clubs called themselves volunteers because they were supposed to perform project activities such as the construction of ICS on voluntary basis. Community meetings were organised to sensitise people on the different interventions and those who were participating in the meetings were trained appropriately for a particular intervention. For example, some people were trained in stove construction. When end-users need a stove, they collect all the required construction materials (see Table 1.3) and then contact the group members who were trained in stove construction to construct a stove for them. CADECOM used a Strength Based Approach (SBA), which emphasised that people should use the skills and materials they have in their local environment to develop their lives.

The type of stove promoted is a basic fixed chimney mud cookstove with three cooking areas (multi pot stove). The middle area is large and designed to take family-size pots and other large cooking vessels, for example, vessels for *nsima* and heating bathing water (Chisoni, 2016a, p. 54). The two side cooking areas are designed for smaller cooking vessels, for example for cooking relish (ibid.) (see Photo 1.5). The chimney is drilled from the stove through the wall and takes the smoke out of the kitchen, but only the hole is visible from outside (see Photo 1.5). The stove was designed to be cheaper, and hence uses local materials. The design is originally from Uganda and some members from CADECOM learnt and brought the technology to Malawi (see Chapter 5, Section 5.2.2.1). The implementation model is completely charitable involving community members.

There is limited documentation and scientific knowledge about thermal efficiency of the stove, combustion efficiency and increased ventilation because of limitations in knowledge development and diffusion, fragmentation of the industry and the learning-knowledge sharing gaps highlighted earlier. However, the stove qualifies as an ICS stove because chimneys improve indoor emissions (ESMAP, 2015, p. xii). Evidence from the study also shows that the stove has improved thermal efficiency or improved heat transfer to the pot (see, Chapter 6, section 6.4.3.1). It is estimated that one bundle of firewood lasts for two to three days when cooking on TSF; yet the same bundle would last approximately two weeks when cooking on the ICS (Chisoni, 2016a, p. 53). This translates to firewood saving of more than three times as much per meal compared to the TSF. This is mainly due to the materials used for construction, especially cow dung (see Table 1.3) and the stove design. Table 1.3 describes the materials required for stove construction, their purpose and quantities.[11]

Table 1.3: Basic fixed chimney mud cookstove construction materials

Material	Quantity	Purpose
Ndhulani[12]	One 20 litre pail	Cementing ingredient that prevents cracks and ensures the durability of the stove
Cow dung	One 20 litre pail	For retaining heat in the stove
Grass	One 10 litre pail	For holding the ingredients together, to make a bond similar to reinforcement wires when making a cement slab
Anti-hill soil	Three 20 litre pails	For bonding with other ingredients
Sand	One 20 litre pail	For holding all the ingredients together, as when making cement concrete
Water		For mixing the ingredients
Banana tree trunk	One medium and 1 small sized	For making openings on the stove: space for placing firewood, for directing fire to the side cooking areas, and for making chimney

Source: Adapted from Chisoni, (2016a, p. 54)

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[11] In Chisoni (2016a, p. 54) the quantities of cow dung and sand were two 10 litre pail measurements. Hence the adaptation in the quantities in Table 1.3.

[12] Ndhulani is a type of soil obtained from an anthill built by a certain type of ants. The anthills are smaller and hard and the soil is dark in colour; the anthill soil has a cementing agent and wound healing properties. In some parts of Malawi this soil is used on a navel of a newly born baby to dry the umbilical cord.

Photo 1.5: Basic fixed chimney mud cookstove (left) and chimney outlets (right) (Chisoni, June 2015)

1.7.3 Chilije Village case study

Chilije village is in Dedza district in the Central region of Malawi. Dedza is located at latitude 14˚22'40.44"S and longitude 34˚19'.59"E. It is under Group Village Headman Tsumbi, Traditional Authority Kachere, and Extension Planning Area Chafumbwa. It is near a government-controlled forest reserve called Dzalanyama Forest Reserve. The case study was constructed with participants from Chilije village. The NGO responsible for promotion of ICS project is Concern Universal, Dedza office, which is about 100km from the study site. It started promoting the cookstove project in April 2011 under Nsamala Sustainable Energy Project and established a production group in the same year. At the time of commencement of the study, the cook stove project was three years-old. It phased out in June 2015, one month after I completed exploratory phase. The nearest trading centre is Mitundu, about 25km from the study site and Kapala. However, the area is remote; few vehicles pass. Concern Universal used a similar implementation model as in Chapita village to disseminate ICS (see Section 1.7.1.3). However, for Chilije, there were some limitations to the model in terms of locating the production group near a good source of clay (see Chapter 5, section 5.2.3.2).

1.7.3.1 Livelihoods in Chilije

More than half of the population of Dedza district is classified as poor and another 20.9% as ultra-poor (Malawi. National Statistical Office (NSO), 2008 and NSO, 2012). In Chilije village the main sources of people's livelihoods are subsistence farming that relies on rain-fed agriculture and resources derived from Dzalanyama Forest Reserve. Some people rely on selling fuelwood products (Katumbi, Nyengere & Mkandawire, 2017) as a coping mechanism against food and cash deficiencies (Munthali, 2013). Marketing of fuelwood products is cost-effective because of the huge demand for charcoal and firewood in urban and sub-urban communities (Katumbi et al., 2017) (see Photo 1.1). Despite the forest being government controlled, people can access the forest reserve without permission. However, sometimes the forest guards are present and they charge a 'small' fee for collection of firewood or felling of trees for charcoal burning. Dambo[13] lands also provide an alternative source of livelihoods. Some people grow

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[13] Dambo is a word used for a class of complex shallow wetlands in central, southern, and eastern Africa.

vegetables, such as tomatoes and leafy vegetables, and other crops, such as sweet potatoes and sugarcane, in dambo lands. Usually these farming activities take place after the conventional farming season and provide the community with an alternative source of food and income. Most people are not employed. Hence, the stove production group saw the ICS production as a viable business and a source of livelihood. Apart from charcoal and firewood businesses, other households are engaged in small-scale businesses such as selling scones, sugar and pig meat. Other businesses include exchanging commodities, for example, some households sell tomatoes in exchange for maize. Tobacco is the main cash crop and source of income for many households, followed by maize. Maize is also a staple food. Other crops include groundnuts, sweet potatoes, cassava, soya beans, beans and millet. Some households raise pigs and chickens.

1.7.3.2 Firewood situation in Chilije Village

As indicated above, Chilije village is near a government-controlled forest reserve, hence firewood is available, but due to forest depletion, collection time and distance is increasing. It now takes about five hours for a return trip. Deforestation is high in Dzalanyama Forest Reserve (Munthali, 2013). According to Katumbi et al. (2017), Dzalanyama Forest Reserve is under massive demolition (p. 891). The main drivers of deforestation and forest degradation are fuel production with charcoal at 40% and firewood production at 32 % (ibid.) (see Photo 1.1). Environmental degradation in Dzalanyama Forest Reserve is affecting water supply in Lilongwe city (Nkosi, 2017). The forest reserve is the source of three rivers: Diamphwe, Lilongwe and Bua. Lilongwe water board gets its raw water from here to supply Lilongwe city (ibid.). It is envisaged that the deforestation rate will continue to accelerate unless there are effective interventions directed at the root causes (Munthali, 2013). With the trends in deforestation, firewood will become scarce in the near future, hence ICS projects in areas around Dzalanyama Forest Reserve are timely interventions to rescue the remaining forest.

1.7.4 Convenience and the Improved Cook Stoves

The two types of ICS promoted in the three case studies are described as convenient. This is chiefly based on the characteristics of the stoves. The characteristics include firewood saving, which helps in saving firewood collection time; production of less smoke, which helps in reducing indoor air pollution; saving cooking time, and for Chitetezo Mbaula, portability is also emphasised by the promoting agents as an important aspect of convenience. For the fixed mud stove, cooking time is saved because of the multiple cooking places, which allows cooking three dishes at the same time, and the amount of heat generated and retained from the stove plus the improved heat transfer to the pot. For Chitetezo Mbaula, cooking time is said to be saved through heat retention and improved heat transfer to the pot. A contested feature of convenience for Chitetezo Mbaula is speed in cooking which relates to cooking time.

Convenience is controversial and it depends from whose perspective, i.e. promoting agents and end-users – what the agents say the stoves do in theory sometimes differs from performance aspects in real life situations (what the stoves actually do). This is an important aspect in relation to the findings of the study (see Chapter 4). For example, from the perspective of the promoting agents, Chitetezo Mbaula is fast when cooking and it is marketed as *"ya changu",* which means "fast". However, this feature is contested from the end-users' perspective (see Chapter 6, Sections 6.3.1.1 - 6.3.1.3) (see also Section 6.3.1.4).

On the other hand, the TSF is considered less convenient because of time spent in searching and collecting firewood; time and energy spent with discomfort in managing smoke in kitchens; time spent in cleaning pots due to lots of smoke. Also, for those households who do not cook in kitchens, the non-portability characteristics become problematic during harsh weather conditions, such as too much heat from sunlight, sudden rains and strong winds.

1.8 Outline of thesis

Chapter 1 introduces the study. It begins with researcher's motivation and proceeds with situating the study. It provides the research context by highlighting demography, environmental problems such as firewood scarcity, deforestation and climate change impacts in the country and globally, the ICS technology and its contribution to addressing some of the problems. Additionally, it reveals the top-down approaches to cook stove dissemination, globally and locally, it provides a history of the evolution of ICS globally and in Malawi and some challenges to adoption of ICS, and the global and local commitments to address environmental health risks associated with biomass burning on open fires. It highlights the centralised and decentralised models to diffusion of innovation and components of technological innovation systems in relation to ICS, the problem it seeks to address. The chapter describes the three case studies involved in the study and it concludes with an overview of the thesis chapters.

Chapter 2 reviews the centralised and decentralised models to diffusion of innovation in relation to the approaches used in dissemination of ICS globally, in Africa, Southern Africa and Malawi. It discusses three dominant approaches, including centralised service delivery, participatory approaches and market-based approaches used in the dissemination of ICSs. It discusses the social marketing strategy as used in ICS promotion and other mechanisms such as financing models and subsidies that aid the promotion of ICS. It discusses the implications of these approaches and strategies in the learning, uptake and utilisation of ICS innovation, by identifying the gaps in the approaches. It then discusses the dominant analytical frameworks used in the analysis of ICS intervention programmes and their implications for a change-oriented learning study.

Chapter 3 discusses the theoretical and methodological frameworks employed in the study. In the first part, it discusses CHAT, the epistemological theory and Critical Realism (CR), which was used to underlabour[14] CHAT. It provides the justification for using these theoretical perspectives. It also discusses conceptualisations of learning. The second part of the chapter concentrates on research design and research approaches employed in the study, the research process, data collection methods, ethical and validity issues. It discusses the two phases employed in the study (exploratory and expansive). It also discusses the formative intervention approach, and how I used Expansive Learning/DWR and the critical realist analytical framework.

Chapter 4 discusses the profile of uptake and utilisation of ICS and the factors that promote and hinder uptake and utilisation of ICS. The first part discusses case-by-case profile of uptake and utilisation, described both quantitatively and qualitatively. It includes among other things, the types of stoves available in a household, the stoves and fuel type used, the size of pots used on ICS, and the frequency of use of each type of stove. The second part discusses factors that promoted and hindered uptake and utilisation of ICS in each case study.

Chapter 5 discusses the findings on the learning taking place among actors in ICS practice in the three case studies as well as at national level fora. It starts with a description of the evolution of each activity system in each case study in relation to the object. It discusses the learning subject in each learning interaction identified, the content of the learning and the ways in which the subjects are learning ICS innovation. It identifies and discusses the directionality of the learning interaction in each case study and the implications for uptake and utilisation of the ICS. It also provides evidence of tenuous interactions between actors, and at the end, it identifies a causal mechanism that appear to shape the way actors are learning the ICS innovation.

Chapter 6 discusses the contradictions identified and analysed from the activity systems in each of the case studies. It starts with a discussion on discursive manifestations used to access the contradictions. After discussing the analysis of contradictions, the chapter concludes with a consolidation of generative mechanisms that appear to influence contradictions across case studies. The chapter uses CHAT's second and third generation to surface contradictions. Four types of contradictions are identified across the case studies, including primary, secondary, tertiary and quaternary. The chapter uses retroductive analysis to surface generative mechanisms that give rise to the contradictions using the lens of CR.

Chapter 7 discusses how I worked with research participants in the Chapita and Waziloya Makwakwa case studies to analyse conflicts and disturbances in their activities and how we searched for ways to

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[14] See Section 3.2.2.1 for the meaning of 'underlabour' as used in the study

find solutions to some of the problems in their practices, using BCCLWs and the Expansive Learning Cycle. The chapter discusses some of the solutions identified, how participants experimented and implemented some solutions. It also discusses some limitations encountered in the search for solutions and implementation. The chapter concludes with identification and discussion of a germ cell in both case studies and how this signifies transformative agency development in research participants and the generative potential of expansive learning processes.

Chapter 8 provides an intensive analysis of the expansive learning processes by mapping Transformative Agency Pathways (TAPs) drawing from Sannino's Vygotskian Double Stimulation Model (Sannino, 2015a) as analytical framework. It discusses how the expansive learning processes enhanced reflexivity and evoked and developed transformative agency in research participants, as well as influenced the mode of interaction among participants during BCCLWs. The chapter discusses how the three theoretical underpinnings (transformative agency, reflective talk and modes of interaction) influenced decision formation and decision implementation.

Chapter 9 provides a synthesis of the thesis; it identifies and discusses key findings from the study, contributions to new knowledge and recommendations emanating from these. The chapter also provides main recommendations for each of the case studies for specific activity systems and recommendations for interventionist researchers. It develops and presents the Innovative Extension and Communicative Methodology for the dissemination of ICSs as one of the major contributions and recommendations to socio-technical transitions that foreground interaction between structural and process elements and ongoing expansive learning in the diffusion of socio-technical innovations. It also discusses some of the limitations to the study.

1.9 Conclusion

This chapter has provided a justification for conducting the study. It has, among other things, provided the research context. It has highlighted the social and environmental problems that the ICS technological innovation seeks to address. It has highlighted the various global and local efforts in promoting ICS to address the problems. It has highlighted the top-down approaches predominant in the dissemination of ICS practice, which appear to have implications for persistence of fuel stacking in almost all ICS interventions. The chapter describes the problem the study seeks to address, goals, research questions and outline of the study. The justification for conducting the study continues in Chapter 2, focusing on dissemination approaches in ICS and major research paradigms predominant in analysing ICS interventions.

CHAPTER 2: A REVIEW OF DISSEMINATION APPROACHES AND ANALYTICAL FRAMEWORKS OF IMPROVED COOKSTOVE PROGRAMMES

2.1 Introduction

This chapter reviews the dominant dissemination approaches employed by different ICS intervention programmes globally, the strategies used in the dissemination of ICS and mechanisms employed to support the dissemination models. The review reveals limitations in terms of uptake, utilisation, and learning of the ICS innovation. The chapter also reviews theoretical frameworks employed in the analysis of ICS innovation programmes, delineated to the context of this study, and identifies the gaps in the frameworks in relation to the learning-centred approach taken for this study.

The chapter begins with a brief discussion of global concerns leading to the introduction of ICS technology in different parts of the world, the places where the technology has been disseminated and progress made in the dissemination efforts globally. It then briefly reviews problems with uptake and utilisation of ICS globally, highlighting fuel-device stacking, followed by a brief review of scholars' responses to the problems. The chapter then reviews three main dissemination approaches: centralised delivery system, participatory approaches, and market-based approaches, with examples provided under each approach to illustrate how the approaches are employed in ICS innovation. I have illustrated participatory approaches used in ICS innovation dissemination using the Adaptive Management Scheme, Participatory Rural Appraisal and formative research. In the case of marketing approaches, I have provided an example of pure commercialisation and social enterprises.

The chapter also reviews mechanisms such as subsidies and financing models used to support the dissemination process and social marketing as a strategy used to reach out to end-users. This is followed by a summary of the implications of the dissemination approaches, highlighting the top-down characteristics within the approaches and associated implications for uptake and sustained utilisation of ICS technology. Further, the chapter briefly reviews some analytical frameworks used to analyse ICS innovation programmes. The review concentrates on Socio-Technical Systems approach because it shares some features with Cultural Historical Activity Theory, which I employed in the study. The discussion leads me to explain why I opted for CHAT.

2.2 Global concerns leading to introduction of ICS technology: A summary

At the beginning of the thesis and in Chapter 1, I captured concerns that led to the introduction of ICS technology globally. The emphasis on concerns for ICS intervention programmes differs in regions, countries or communities adopting the technology. In my reading of literature on ICS adoption, I have identified four major concerns that lead to the introduction of ICS technology: (1) *Environmental concerns*, including increased deforestation, environmental degradation, climate variability, and climate change; (2) *Health and well-being concerns*, including indoor air pollution and the associated deaths and diseases, and injuries from burns; (3) *Economic concerns*, including poverty; (4) *Social concerns*, including scarcity of biomass fuels, such as firewood, the associated burden placed on women and girls, taking girls away from school, as well as sexual harassment during fuelwood collection (see also Section 1.4).

Apart from addressing these concerns, the potential benefits from ICS technology (see Chapter 1) also draw the attention of donor organisations, NGOs, and governments. Above all, ICS technological innovation can contribute to progress on six of the eight United Nation's Millennium Development Goals as indicated in Table 2.1 below:

Table 2.1: Potential benefits of ICS in the progress of the United Nations Millennium Development Goals

Millennium Development Goal	Potential benefit
Goal 1: Eradicate extreme poverty and hunger	Decrease income spent on cooking which can be used to purchase food and other necessities, provide a source of livelihood for rural production groups.
Goal 2: Achieve universal primary education	Increase school enrolment and staying in school by decreasing the need for children to collect biomass fuels and prepare cooking biofuels.
Goal 3: Promote gender equality and empower women	Decrease the time women and girls spend gathering biomass. Decrease particulate matter in households.
Goal 4: Reduce child mortality	Decrease the amount of particulate matter and carbon monoxide linked to respiratory and cardiovascular diseases of which children are exposed to inside dwellings and in the company of their mothers during cooking.
Goal 5: Improve maternal health	Decrease exposure to harmful particulate matter and carbon monoxide and labour by women collecting, transporting biomass fuels, and preparing biofuels and sexual harassment associated with firewood collection.
Goal 7: Ensure environmental sustainability	Reduce consumption of biomass and emissions linked to climate change.

Source: Adapted from Bielecki and Wingenbach (2014, p. 351)

2.3 Progress in ICS dissemination efforts globally

There are many different cookstove programmes globally implemented by different institutions: NGO-led programmes, international development agency-sponsored programmes, government-led programmes or private initiative programmes (Urmee & Gyamfi, 2014, p.630). The ICS programmes are scattered in regions that predominantly use biomass as the main cooking fuel in low and middle-income countries. The regions that chiefly rely on solid fuels as the main cooking fuel include Africa, Americas, Eastern

Mediterranean, Europe, South East Asia, Western Pacific, and Sub-Saharan Africa (ESMAP, 2015). Figure 2.1 below shows biomass cooking technologies by region. Of particular focus is the Traditional Solid Fuel Stoves (which include Three Stone Fire (TSF)/open fires), ICSs, and Minimally Improved Chimney Stoves.[15] However, ICS technology is combined with Advanced Cookstoves[16] on the map. It is worth noting that the largest shares of traditional unimproved solid fuel stove users are in Sub-Saharan Africa (71%), South Asia (66%), and Southeast Asia (41%) (ESMAP, 2015, p. 95).
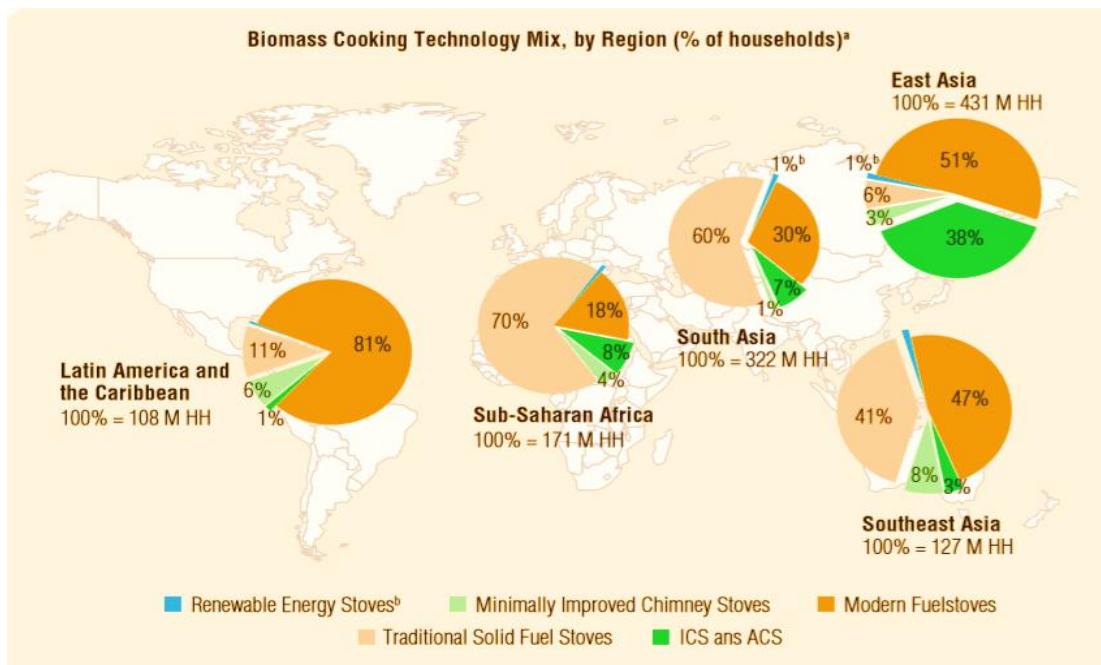
*Figure 2.1: Biomass cooking mix by region[17] (*Source: ESMAP, 2015, p. 95*)*

From around 1980s, ICS penetration has progressed with variations in different regions. By 1984, there were a few thousand ICS programmes around the globe (see Figure 2.2) (Urmee & Gyamfi, 2014; ESMAP, 2015). In 1990s, evidence shows that there was a substantial growth in ICS programmes, as well as distribution of ICSs (Urmee & Gyamfi, 2014). By 2010, there was noticeable penetration of ICS programmes around the world (Urmee & Gyamfi, 2014; ESMAP, 2015). Figure 2.2 shows the transitions

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[15] Solid-fuel cookstoves whose chimneys feature minimal to moderate improvements in thermal efficiency (ESMAP, 2015, p. xiii.)

[16] Advanced Cookstoves (ACS) are fan draft or natural draft biomass gasification cookstoves that achieve significant particulate emission reductions and approach, but do not yet match the performance of modern fuel cookstoves (IWA ISO Tier 3 for indoor emissions, Tier 3-4 for efficiency) (ESMAP, 2015, p. xiii)

[17] Figure 2.1 uses "data estimated for 2012 baseline year using 2010-14 source information at country level; aggregated up and triangulated to remove duplication; it is an upper bound estimate since, in the absence of survey data for many countries, the analysis assumes one stove per household, an overly conservative assumption for portable improved stove technologies" (ESMAP, 2015, p. 95).

regions have made from around 1980s to around 2010 (the coloured areas in Figure 2.2). The colour differences in Figure 2.2 are not significant for the focus of this section.

Figure 2.2: Cookstove programmes transition
Source: Gifford, in Urmee & Gyamfi (2014, p. 630)

Despite the progress made in ICS technology dissemination, access to clean cooking[18] is still a challenge. According to a 2017 World Bank report, 3.04 billion people lived without access to clean cooking in 2014 (World Bank, 2017, p. 6). The largest of the population is in Asia-Pacific and Africa (ibid.). Figure 2.3 shows percentage of population with access to clean cooking on the world map in 2014.
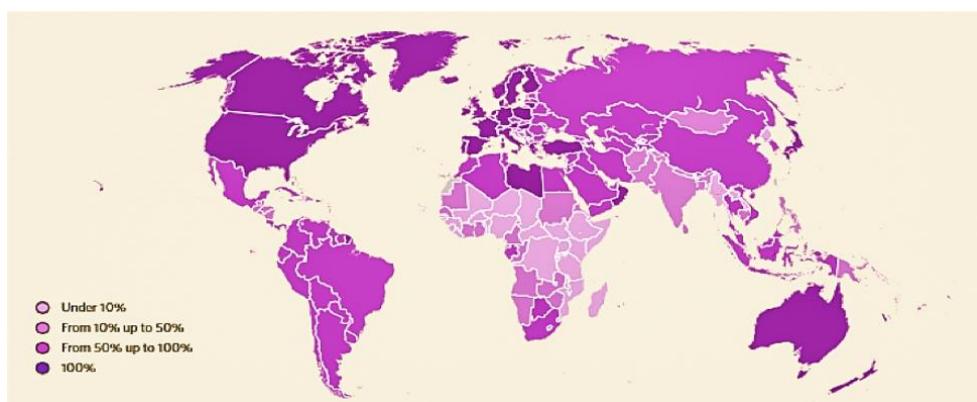
Figure 2.3: Access to clean cooking, 2014
Source: The World Bank, 2017, p.6

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[18] Clean cooking combines access to clean fuels and technologies for cooking, which can be achieved typically through switching to liquefied petroleum gas or adopting advanced combustion cookstoves that burn biomass more cleanly and efficiently (World Bank, 2017, p. 6).

2.4 Problems in the uptake and utilisation of ICS globally

There is overwhelming evidence of the problems with uptake and utilisation of improved cookstove technology globally. Studies have pointed out that ICSs have failed to take off in a big way in developing countries, except in China, Cambodia and some programmes in Kenya and Sri Lanka (ESMAP, 2015; Ruiz-Mercado & Masera, 2015; Urmee & Gyamfi, 2014; Chaurey et al., 2012; Zerriffi, 2011; Kees & Feldmann, 2011; World Bank, 2011; Shrimali, Slaski, Thurber & Zerriffi, 2011; Bailis, Cowan, Berrueta & Masera, 2009; Barnes et al., 1993, to mention a few). Despite enormous diversity and complexity of stove programmes implemented in different regions of the world, including Africa, South Asia, Latin America, East Asia, and the Caribbean, there are five major reasons for failure of the programmes. These include dissemination approach used, the technology involved, lack of proper understanding of the needs of the people who use the technology, fragmentation of efforts and insufficient attention to scalability and sustainability issues (ESMAP, 2015; Urmee & Gyamfi, 2014; Kees & Feldmann, 2011; Shrimali et al., 2011; Ruiz-Mercado & Masera 2015; Troncoso et al., 2011; Barnes et al., 1993; World Bank, 2011). Due to these reasons, the ICS intervention programmes have failed to necessitate change in user habits, cooking and lifestyle changes, which has led to low motivation (Chaurey et al., 2012) on both the consumer and the supply side. Despite the fact that some programmes have been successful and achieved their set objectives, satisfying the cooking needs of the users, taking into consideration their cooking behaviour and preferences while improving overall efficiency still remains a challenge (Urmee & Gyamfi, 2014, p. 626). This challenge has also resulted in the failure of many programmes (ibid.). In commenting on the success and failure of ICS programmes, Ruiz-Mercado et al. (2011) remarked that for a programme to achieve its goals and claim success, people must adopt the technology and continue using it in the long term.

The 2011 World Bank report estimated that there were 166 million cookstoves still in use in the field. "Of these ICSs, 116 million were in China, more than 13 million in the rest of East Asia, nearly 22 million in South Asia, about 7 million in Sub-Saharan Africa, and over 8 million in Latin America and the Caribbean" (World Bank, 2011, p. 4). That some 166 million ICSs were still in use was considered quite a legacy for the efforts of many countries and donors (ibid.). However, according to Shrimali et al. (2011), it is unclear what fraction of households possessing ICSs actually use them on a regular basis (p. 7543).

2.4.1 Fuel-device stacking

Historically, the full displacement of traditional cooking fuels and stoves, by modern clean fuels or ICS has been difficult, yet stacking has been commonly observed in different parts of the world (Ruiz-Mercado & Masera, 2015). Stacking occurs in different patterns: simultaneous use of several stoves on each day and alternation of stoves (Ibid.) to cook specific dishes. Stacking of fuels and devices has been

documented in the energy literature over the last four decades (ibid., p. 43). Due to this, realisation of tangible health-environmental and socio-economic benefits has proven elusive because even when the promoted fuels and ICSs are used in the long term, they are often combined (i.e. stacked) with the traditional ones to fulfil all household needs originally met with open fires (ibid., p.42).

A number of countries have documented fuel-device stacking, for example, China, Indonesia, Mali, India, Mexico (Ruiz-Mercado & Masera, 2015) and Malawi (Jagger & Jumbe, 2016), to mention a few. In some cases, displacement of traditional fires has proved unattainable, even with well-designed stoves that are adapted to cooking practices (Ruiz-Mercado & Masera, 2015; Troncoso et al., 2011).

Ruiz-Mercado & Masera (2015) observed that although stacking of fuels and devices embodies the dynamic interplay of elements in the ICS technological innovation system, the interactions have received little attention. They also have observed that studies have not conducted in-depth analysis and examination of stacking (ibid.). Thus as indicated in Chapter 1, the present study critically addresses device stacking via CHAT allowing a focus on the interaction between the elements of the ICS technological innovation system (see Chapter 3) with a Critical Realist lens explaining the phenomena beyond the actual and empirical (Sayer, 2000; Benton & Craib, 2001) to find the real. Since the surface appearance of things may be potentially misleading as to their true character (Benton & Craib, 2001, p. 120) (see Chapter 3). Stacking has adverse consequences because the very intention of introduction of clean fuels and clean cooking technologies is defeated, such as reduction of harmful emissions (indoor air pollution) and sustainable consumption of woodfuel (Ruiz-Mercado & Masera, 2015).

In relation to stacking has been the abandonment of ICSs. For example, Troncoso et al. (2011) found out that some women in a study conducted in Mexico had stopped using their ICS even with proper follow-up after installation of an ICS by the implementing team. This tendency has also been observed in Malawi (see Chapter 1) and in India (Kumar, Chalise & Yadama, 2015).

2.5 Scholarly responses to problems with uptake and utilisation of Improved Cook Stoves: A summary

Due to the problems highlighted above, efforts have emerged to understand the complexities of the adoption of ICSs, a topic that has remained a key challenge in the 40 years of stove dissemination (Ruiz-Mercado & Masera, 2015, p. 42). These efforts have included existence of a growing body of empirical evidence emanating from stove programmes and case studies that have documented energy choices and employed different conceptual frameworks to describe the transitions from traditional cooking technologies to ICS technologies (Ruiz-Mercado & Masera, 2015). Other studies have employed new

monitoring technologies of stove use and provided quantifiable facts of the dynamic patterns of household cooking practices (ibid.). Other efforts have been directed towards understanding what practitioners need to know and to do about the ICSs and fuel choices in order to ensure utilisation, so that the target population reap the intended benefits (ibid.), for example ESMAP, 2015; Rehfuess et al., 2014; Stove*plus* & GIZ, 2014. These efforts have given rise to different theoretical frameworks employed to analyse the problematic situations (see Section 2.12). Efforts have also culminated in an examination of factors influencing adoption of ICS and fuels, for example Simon, 2010; Troncoso et al., 2011; Rehfuess et al., 2014. According to Ruiz-Mercado and Masera (2015), these factors have been explored in literature since the 1980s (p. 43). Some of the factors highlighted from a few studies include problems with top-down approaches to diffusion, problems with interventions that focus only on cooking technologies and poverty (ibid.). In Chapter 1 (Section 1.4.4.1), I have explained the factors in their categories.

Ezzati and Kammen, in Ruiz-Mercado and Masera (2015), commenting on the situation, emphasised that "the varying levels of success of fuel change and stove programs implied that the factors motivating households to adopt interventions were not entirely clear" (p. 43). In a systematic review on enablers and barriers to large-scale uptake of biomass ICSs, Rehfuess et al. (2014) identified 31 factors influencing uptake from 57 studies conducted in Asia, Africa and Latin America; they concluded that "all factors can be influential, depending on context" (p.120). Similarly, van der Kroon, Brouwer and van Beukering, in Ruiz-Mercado and Masera (2015), in their study concluded that the factors could not be ranked by degree of importance (p. 43). This is consonant with what I pointed out in Chapter 1 that literature fails to provide a nuanced understanding of the interplay of the constraints and enablers influencing the uptake, use, and diffusion of ICSs. Hence, as I argued in Chapter 1, the significance of the study and one of its contributions to ICS diffusion and adoption studies is the shift from the language of "enablers and barriers" to "contradictions" in the diffusion of ICS innovation, which are a source of learning and development.

Further, it is interesting to note that there appears to be more studies focusing on access to ICS, scaling-up (or adoption), with few focusing on sustained use (Rehfuess et al., 2014).

2.6 Dominant dissemination approaches of ICS globally

The way in which diffusion of a technology is carried out is an important aspect of the adoption process and one over which change agents can have an influence (Troncoso, 2011, p. 7605). Globally, ICS promoting agents have used three major approaches in the dissemination of the technology. They include (1) centralised service delivery also known as expert-led; (2) participatory approaches also referred to as context-responsive; and (3) market-based approaches also known as commercialisation approaches or

business models. The approaches are linked to the three phases of ICS development from around 1970 (see Chapter 1, Section 1.4.4.1). The approaches are distinct but overlapping (like the phases) with each dominating a particular phase of stove development (see Sections 2.6.1, 2.6.2 and 2.6.3). Apart from the three approaches, there is a combination of the centralised service delivery and market-based approaches called social enterprise. Social enterprise is employed in many programmes more so than pure commercialisation approaches. Other programmes have combined aspects of all three approaches: commercialisation strategies, participatory strategies and centralised service delivery strategies. Market-based approaches employ other mechanisms such as subsidies and financing models to aid uptake of the technology, especially for poor consumers. Social marketing strategies are used to reach out to end-users of the technology with different promoting agents employing variants of the strategy.

2.6.1 Centralised service delivery

Centralised service delivery, also commonly referred to as donor and/ or government distribution models or government-led approaches, have been used in the earliest efforts to improve access to cleaner cooking fuels (Zerriffi, 2011). Major government programmes have disseminated thousands of new cookstoves to rural villages in different countries (Urmee & Gyamfi, 2014). In the 1980s, dissemination strategies mainly focused on self-help approaches or distribution of free stoves (Kees & Feldman, 2011, p. 7596). Despite the fact that it was a predominant approach in the earliest ICS initiatives, it has been used in some stove programmes in the recent decade, for example in Malawi (see Section 2.9), Mexico (Troncoso et al., 2011) and in Senegal (ESMAP, 2016). A combination of international donors, central and subnational governments as well as NGOs have largely funded, coordinated and implemented these efforts (Zerriffi, 2011, p. 273). The basic idea during this period was to deploy a win-win opportunity for rural citizens to benefit by saving fuel wood while reducing deforestation (Urmee & Gyamfi, 2014).

Under the centralised delivery model, a few cookstove programmes managed to distribute a few thousand cookstoves by 1984 (Urmee & Gyamfi, 2014, p. 630) (see Figure 2.2). Some countries with well-established programmes had distributed or sold up to 5000 ICSs; these included Guatemala, Southern India, Indonesia, Kenya, Nepal, Papua-New Guinea, Senegal, Somalia, and Sri Lanka (Manibog, as cited in Urmee & Gyamfi, 2014, p. 630). Some countries also sold a significant number such as Burundi, Malawi, Mali, Niger, and Rwanda (Urmee & Gyamfi, 2014, p. 630). Another group where minimal initiatives took place included Bangladesh, Botswana, Fiji, Gambia, Lesotho, Liberia and few Central American/Caribbean countries (ibid.).

The centralised delivery model continued up to around 1990s and it made progress for the first time in ICS distribution. This period is associated with the emphasis on the link between indoor air pollution and traditional cookstoves, leading to the concept of ICS gaining popularity and resulting in the substantial

growth of the ICS industry as indicated above (Urmee & Gyamfi, 2014). During the same period, large government programmes were initiated in China, India, Bangladesh, Sri Lanka, Nepal, Africa and Latin America (Urmee & Gyamfi, 2014, p. 630).

However, literature shows that ICS programmes in the mid-1980s had mixed success (Zerriffi, 2011, Shrimali et al., 2011 and Sesan, 2014). For example, programmes such as "the India's first national cook stove programs were successful in dissemination but less successful in sustaining long-term changes in energy systems" (Zerriffi, 2011, p. 273). Similarly, other programmes failed to scale up, especially smaller NGO programmes, which targeted smaller geographic regions that could not expand, or donor projects that failed to thrive once funding was no longer available (ibid.). In general, many past efforts to disseminate ICS, primarily by governments and NGOs were not successful (Barnes et al., 1993; Troncoso et al., 2007; Shrimali et al., 2011; Lambe & Atteridge, 2012). Manibog, as cited in Urmee and Gyamfi (2014), remarked in the World Bank report,

> After years of promotion efforts, large-scale diffusion has not occurred. Fewer than 100 000 stoves have been distributed worldwide, of which 10-20% have fallen into disuse, and another 20-30% are used only intermittently. (p. 630)

Several reasons are attributed to the failure. The main causes of collapse are mostly attributed to poor implementation approaches, inappropriate technologies, lack of community participation, and lack of training (Urmee & Gyamfi, 2014, p. 634). Evidence shows that the approaches were not always supportive for the construction of high quality stoves, which resulted in "creating a negative image of stoves that break easily, that are not worth spending money on and consequently are not used" (Kees & Feldmann, 2011, p. 7596). Some reasons given for discontinuing use were that the stoves did not really save energy, did not eliminate smoke, or were broken (Urmee & Gyamfi, 2014, p. 634). This meant that programmes failed to offer consumers something that would make them change from traditional cooking methods (Shrimali et al., 2011). For example, failure to take into account local cooking cultural practices (Urmee & Gyamfi 2014).

"The Indian National Program on Improved Chulhas (NPIC) is often cited as emblematic of the kinds of programs that can go wrong with government-run cookstove initiatives" (Shrimali, 2011, p. 7543). It distributed 32 million stoves in the period 1983-2000 and a 1995-1996 survey showed that perhaps 60% of stoves distributed to that point were still in use (Sinha, in Shrimali et al., 2011, p. 7543). It is envisaged that the number has declined significantly since then, given lack of ongoing government support and the ultimate withdrawal of the programme (ibid.). The NPIC was criticised for poor stove design, low quality, high programme cost and low uptake rates (ibid.). It also heavily subsidised stoves, and this destabilised pre-existing local markets for stoves (Barnes et al. in Shrimali et al., 2011).

The emphasis of the centralised delivery approach was technological (Sesan, 2014), and not on the involvement of the key actors in the diffusion process. It was dominated with lay-expert working relationships between those perceived as experts; the savvy technicians or engineers and women as lay cooks, a clear top-down implementation approach (Sesan, 2014). Crewe, as cited in Sesan (2014 p. 7), critically commented on this:

> local women were not involved in stove development; they were only invited to test a model's 'acceptability' after a round of technical improvements had been completed because their internalised perceptions of the everyday activity of cooking were deemed to be inferior to the 'objective' technical parameters that stove engineers brought to bear on the design process.

Practitioners then realised that the centralised distribution and large subsidies as solutions to the energy access problem were insufficient (Zerriffi, 2011, p. 273). The early failures from this first dissemination approach provided lessons to ICS programme implementers (Sesan, 2014; Urmee & Gyamfi, 2014) to inform determinants for implementing successful stove programmes (Urmee & Gyamfi, 2014).

The top-down approach in improved stove dissemination began to shift with the introduction of participatory approaches around the late 1980s (Sesan, 2014). However, concerns on technologically driven ICS programmes and quality issues of products persist as major issues for programme failure presently. Improved cookstoves are still designed in laboratories to optimise efficiency rather than convenience related to cultural cooking practices (Urmee & Gyamfi, 2014, p. 635).

2.6.2 Participatory approaches

Participatory approaches in ICS innovation can be mostly traced to the early 1990s, when the researchers on a Commission of the European Communities (CEC) funded project employed a radically different approach which encouraged active local participation and open communication in a deliberate attempt to minimise outsider bias in the process (Sesan, 2014). As indicated above, the shift to participatory approaches developed out of lessons learned from the failures of the centralised service delivery approach. Hence, this period is also referred to as "the context-responsive stove intervention" (Sesan, 2014; Honkalaskar, Bhandarkar, & Sohoni, 2013). Participatory approaches were considered as vital for facilitating a detailed understanding of user needs and paramount for the success of any development programme (Rouse in Honkalaskar et al., 2013, p. 3). During this period, there arose a general realisation among practitioners that the cooking technology intrinsically involves diverse local contexts and traditional meanings attached (Sesan, 2014). Hence, the only way to gain insight into the workings of 'traditional' contexts was to work with local people, particularly women, rather than on their behalf (ibid., p. 8) (emphasis in original). Further, this approach put forward that any stove project should perceive and incorporate women as 'experts in the field' (Germann, in Sesan, 2014, single quote emphasis in original). Hence, practitioners developed an understanding of the need to adapt the stove to the socio-cultural,

economic and environmental specifications of local contexts as a prerequisite for a successful stove programme (ibid.). This understanding underscores the need for active participation and engagement of local partners at all stages in stove projects (Sesan, 2014).

NGOs, especially those that worked at the grassroots, began to encourage local people to participate in cookstove programmes and knowledge production processes (Honkalaskar et al., 2013; Sesan, 2014). The movement also brought more attention from outsider organisations to establish autonomous, self-sustaining mechanisms of stove dissemination than in the first phase, in order to improve stove uptake (Sesan, 2014). Sections 2.6.2.1, 2.6.2.2 and 2.6.2.3 provide a few examples[19] of programmes that incorporated participatory approaches in cookstove dissemination.

Despite employing participatory approaches and having a renewed focus on dissemination systems, stove dissemination in local communities as well as stove uptake was generally low in the same way as was during the centralised delivery service (Barnes et al., in Sesan, 2014 and Honkalaskar et al., 2013). These problems led to the search for other more effective and self-sustaining alternatives to reach the poorest in different contexts, which led to the market-based approaches to cookstove dissemination (Sesan, 2014) (see Section 2.6.3). The success story of a self-sustaining market-based approach adopted by the Chinese National Improved Stove Programme (NISP) also added impetus to international governments and non-governmental agencies to follow market-based approaches (Honkalaskar et al., 2013, p. 2).

2.6.2.1 The adaptive management scheme in improved cookstove dissemination
The adaptive management scheme is an example of participatory approaches used in ICS dissemination programmes. Adaptive management as an approach to natural resource management was first documented by Beverton and Holt (1957) and subsequently Hilling (1978) and Walters and Hilborn (1978) developed it with the name 'adaptive resources management' (William, 2011). Later, Walters (1986) elaborated it with adaptive decision-making (ibid). In natural resources, adaptive management refers to a structured process of learning by doing and adapting based on what is learned (Walters & Holling, 1990 in Williams, 2011, p. 1347). This learning "occurs through informative practices of management, with management strategy adjusted as understanding improves" (Williams, 2011, p.1347). It integrates design, management, and monitoring processes employed to test assumptions systematically in order to

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[19] The purpose here is not to be exhaustive, rather to illustrate how participatory approaches have been used in ICS dissemination in the cases discussed; some cases provide evidence for the continuation of top-down aspects in the participatory approaches, at the same time providing the strengths in the approaches for ICS diffusion. I have reviewed these participatory approaches because they are among the more common approaches in development and intervention programmes (Chambers, 1994; Chandra, 2010 and Parfitt, 2004)

adapt and learn (Salafsky, Margoluis & Redford, 2001 p.13). The two fundamental features of adaptive management as a learning-based process includes learning which happens through an increased understanding over time and adaptation in the management through time which is based on the learning (Williams, 2011; Salafsky et al., 2001). One of the key steps in adaptive management is participation of stakeholders in assessing the resource problem, and reaching agreement about its scope, objectives and potential management action (Williams, 2011, p. 1348). However, the involvement of stakeholders may vary among projects depending on scale and complexity of the application (ibid.). Learning in adaptive management is described as an iterative learning process that involves decision-making and actions by management based on objectives, resource status and understanding; follow-up monitoring which produces data used to assess impacts and update understanding; and assessment, with results that guide decision-making at the next decision point (Williams, 2011; Salafsky et al., 2001).

Adaptive management, as employed in ICS diffusion, is an approach in which findings and lessons learnt in an ICS implementation programme provide feedback to the subsequent programme's aspects, which results in improvements. The improvement especially occurs in the diffusion programme and in modification and redesign of the ICS technology itself (Troncoso et al., 2011; Tandon & Penjor, 2014) or of a retrofitted device in the ICS (O'Shaughnessy, Deasy, Doyle & Robinson, 2015). The application of adaptive management is based on the understanding that an innovation will be maintained over a long time if the innovation adapts to the user's needs (Troncoso, 2011). Further, the innovation is highly compatible with the user's needs and resources and that users feel involved and regard the innovation as "theirs" (quote in original text) (Troncoso et al., 2011, p. 7601).

Troncoso et al. (2011) reported on an adaptive management scheme in Purhépecha region in Mexico where the three planned stages of the implementation programme led to a different model of an ICS technology and changes in the diffusion strategy in each of the stages. In this particular case, there was an integrated training and diffusion strategy involving the dissemination team and women from the community in the first stage. Meetings were organised for the group and the dissemination team explained health problems due to smoke and the benefits of the ICS. The dissemination team followed the interested people and sensitised them further on the benefits of the stove. They then built them an ICS after an agreement was reached. The users were responsible for material, labour costs, and follow-up costs. There were about three follow-up meetings after the stove construction where the stove builder offered technical assistance in stove use and maintenance.

During the second stage, the users had no accompaniment in the first months of the adoption process but follow-ups were done during field visits. However, differences in several aspects of the diffusion

strategies and technology did not seem to have affected the results in terms of adoption rates, particularly taking into account that in the first stage women paid for the ICS while in the second stage, it was free (Troncoso et al., 2011, p. 7606). Some women had also stopped using the stoves despite follow-ups every month by the implementing agents (ibid.).

The third stage involved the design and diffusion of a third ICS model derived from a purpose-specific model designed for tortillas[20] (Troncoso et al., 2011, p.7607) and stoves were given free. In this stage, the adoption rate was higher compared to the two earlier stages (ibid.). The authors did not comment on stacking in the case study, however, stacking has been reported in other regions of Mexico with the existence of well-suited models for making tortillas in some households (Ruiz-Mercado & Masera, 2015). Hence, adaptive management may not guarantee sustained use of the ICS, even though it may increase stove usage (see Ruiz-Mercado & Masera, 2015).

Some strengths of adaptive management scheme, as reported in this case, are: first, it can lead to technology improvement when problems identified by users in previous stages are addressed in subsequent ICS models. The technology improvement was associated with high rate of adoption (Troncoso et al., 2011, p. 7607). The approach also allowed late adopters[21] to know and get used to the ICS (Troncoso et al., 2011) hence allowing them to adopt the technology faster than probably would have been expected. Second, it combined technology-centred and people-centred approaches. The technology-centred approach focused on solutions that are based on improvement of a technology, which would make it easier to use, independent from an implementation programme (ibid., p.7608). On the other hand, the people-centred approach focused on a close interaction with users in order to make them aware of the problems the ICS was trying to solve and enable them to learn about using the technology (ibid.).

However, the major drawback is that using an adaptive management approach in an ICS dissemination project is extremely difficult because it is difficult to find financial support for projects that include follow-up or monitoring activities (Troncoso et al., 2011, p.7606). This is because donors finance the cost of a device, but if it is necessary to rebuild an ICS or to come back to a community in order to solve particular adoption problems, nobody pays for these tasks (ibid.). In addition, in this particular case schedules had to fit with commitments with donors in terms of both timing and quantity of devices implemented (ibid.) or distributed.

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[20] A tortilla is a type of thin, underleavened flat bread, made from finely ground maize it is a staple food in some parts of Mexico.

[21] Late adopters are a second group of people to adopt a technology after the first group has already adopted (Rogers, 2003)

Apart from communication problems and unfavourable interaction between the implementers, i.e. field workers and decision-makers, the approach also suffered from top-down approaches emanating from commitment with donors which added pressure because of tight schedules and affected planning time (Troncoso et al, 2011, p.7605) and failure to consider the opinions of end-users (ibid. p.7604) among other things.

While the approach may influence acceptance and initial use of the ICS, it may not guarantee sustained use of the technology, which is the focus of this study. This is because the learning process focuses more on the end-users, not all the actors. The implementers' learning is focused only on modifying the delivery of a technology and a diffusion programme. The type of learning did not evoke, enhance, and support reflexive actions and transformative agency in all the key actors. Reflexivity and transformative agency are key in learning for sustainability and transformation of the ICS practice (see Chapter 3, Sections 3.3 and 3.4.1). Further, the actors were working with and on various objects and had not constructed a shared object, which may lead to more collaborative efforts (see Chapter 7).

O'Shaughnessy et al. (2015) reported another case that used 'adaptive design'. The project was conducted in Malawi in two districts, Balaka in the first stage and Ntcheu in the second stage. The project aimed at developing a thermoelectric generator (TEG) powered by heat produced from a biomass-fed cooking stove, Chitetezo Mbaula. The adaptive design approach used stakeholder and user feedback gathered from the initial technology demonstrator field trials to inform design improvements of a re-engineered technology demonstrator. The project was based on the assumption that the addition of an electrical generator to an ICS could make it more attractive than the traditional cooking methods. It was assumed that the technology would help tackle the energy access problem encountered by the people through generating power during normal cooking practices with the ICS for charging mobile phones, LED lanterns, and radios.

The improvement from the first stage was a less expensive generator design, which was mechanically more robust and easier to assemble than the initial design. This was retrofitted in ten Chitetezo Mbaula stoves in Ntcheu, and the stoves were left in the field for six months of experimentation.

Households that participated in the experiment were instructed that electricity would be generated during normal stove operation and that there was no need to burn more fuel or use the stove for longer periods (ibid. p. 45).

Major findings reveal that none of the TEG stoves were used every day, indicating that the users operated other stoves and /or cooking methods based on their preferences (ibid. p. 50). Similar to the first stage, stove usage was erratic but intense (ibid.). Stove users also preferred to charge their devices when the

stove was in use rather than wait and use the energy stored in the battery. Hence, the necessity of attaching a rechargeable battery was questionable, and an option to remove the battery was considered for the third stage of the adaptive design process so that charging would be direct from the TEG. There were also cases where some stove operators used their stoves only to generate electricity during the first stage (ibid. p.47), not for cooking.

As part of the adaptive design process, feedback from the second stage was subsequently used in the third stage. The technological improvements included re-designing the generator and the circuitry, with generator components manufactured in Malawi in order to reduce the cost of the generator.

This case demonstrates that even with added benefits on the ICS, as long as these benefits are defined from the implementers' perspective, users will be reluctant to utilise the technology, 'perhaps' unless if the technology did not change the existing cookstove design (see for example, Honkalaskar et al., 2013). More importantly, the behaviours and habits of end-users as evidenced from the case, require much more than technological solutions; it calls for a learning process that would stimulate reflexivity, however, not only among end-users, but also key actors in the ICS practice for a reflexive 'ICS' society (see Chapter 3, Section 3.4.1).

2.6.2.2 Participatory Rural Appraisal in household energy and improved cookstove intervention
Participatory Rural Appraisal (PRA) is a "family of approaches and methods employed to enable rural people to share, enhance and analyse their knowledge of life and conditions, to plan and act" (Chambers, 1994, p. 1253). PRA draws from a number of traditions including activist participatory research, agroecosystem analysis, applied anthropology, field research on farming systems and Rapid Rural Appraisal (RRA) (Chambers, 1994; Chandra, 2010). PRA is one of the most popular participatory methodologies among principal participatory approaches in mainstream development (Chandra, 2010; Parfitt, 2004). PRA grew out of the need to shift from outsider-led research activities to local people-led research activities where the outsiders assume the position of facilitators and convenors (Chandra, 2010; Chambers 1994). PRA evolved from RRA in the 1980s and 1990s with the ideal objective to empower local people (Chambers, 1994). According to Chandra (2010),

> the shift from conventional surveys onto rapid rural appraisal was based on the realization that RRAs were not very participatory and the accuracy of information was low. This led to a shift towards PRA with the aim of increasing involvement of the respondents. (Unpaged)

As a result, PRA emphasised "handing over the stick" to symbolise local people's control over the process (Chambers, in Chandra, 2010, unpaged, quote emphasis in original). There are about eleven principals of PRA (Chandra, 2010). For the purposes of the study, I would like to highlight a few: (1) Rapid

progressive learning which is flexible, exploratory, interactive, and inventive; (2) Reversals which entail learning from, with and by local people, eliciting and using their criteria and categories; (3) Seeking diversity and differences, and changing behaviours and attitudes (of implementers) from dominating to facilitating, empowering and enabling local people to conduct their own analysis. With various approaches and methods applicable to PRA, researchers using PRA use a selection of them depending on the object and environment of the study and tend to have an upper hand in choosing what stage and how local communities participate. Some researchers may work under the label PRA when their approaches are extractive rather than participatory, their behaviour and attitudes dominating, top-down and unchanging (Chambers, 1994) while some misuse PRA techniques and tend to dwell more on efficiency rather than empowerment (Parfitt, 2004). In fact, the term 'participatory' or 'participation' in PRA has been challenged because it can be used to mean people's participation in outsider projects instead of establishing ownership of plans, actions and projects with local people themselves (Chambers, 1994). This tendency has been observed in ICS projects (see for example, Sesan, 2014; Troncoso et al, 2011).

In the cookstove sector, Malhotra, Neudoerffer and Dutta (2004) reported on a case in India, a village called Gari Natthe Khan in Gurgaon district. The project was carried out with the partnership of Tata Energy Research Institute, India, and the University of Waterloo, Canada project. The main idea was to recognise women as full partners in the development process and concretely include them in the process of designing household energy programmes (ibid.). The partners also worked with the hypothesis that "a definite role for local communities, especially women in every phase of planning, design and implementation of rural energy programmes would lead to more successful and effective dissemination" (ibid., p.152). This conceptualisation is also recognised in Socio-Technical Systems (STS) literature (for example, Geels, 2004; Atteridge et al., 2013) to explicitly incorporate end-users of the innovation as they influence innovation and diffusion processes (see Chapter 1).

The implementers used PRA techniques, combining interactive information gathering and evaluation exercises with group decision-making. Nevertheless, end-users were involved in some stages, not all stages of the processes, to reflect the hypothesis. For example, end-users were involved in assessment and prioritisation of needs of the community. However, the community's prioritised needs clashed with the findings of the implementers emanating from survey assessments conducted (Malhotra et al., 2004, p. 165). This resulted in a sensitisation process about the energy problems women were facing since this was in the agenda of the implementers.

The strength of the PRA approach as employed in this case is that it led to a technological solution with some input from the end-users despite the implementer playing a greater part in influencing the type of

technological innovation implemented, which they based on the survey findings, rather than the community's perspective. The limitation was that the methodological design concentrated on technological solutions (a new biomass fuel – a briquette), influenced by the implementers' agenda, rather than on instilling reflexivity (see Chapter 3, section 3.4.1). As far as the methodology sensitised the community members on the problems encountered with fuel wood shortage and collection, it was limited in evoking reflexivity in the community members on cooking practices and daily routines that may limit high levels of fuel consumption while using a new biomass fuel implemented. Similarly, the methodology did not create space for evoking transformative agency among community members that may help them find ways of resolving their own problems beyond the project's life.

Another case that employed aspects of PRA techniques is the improvement of a traditional cookstove, which was carried out in a tribal village Gawand wadi in India (Honkalaskar et al., 2013). Local people participated in the project through identification of the projects based on their needs and desires, demonstration of the existing cooking practices and conducting field level experiments towards the improvement of the traditional stove (ibid.). However, as the authors pointed out, it was not possible for community members to participate in technical and analytical stages of the projects, which were carried out in the laboratory. Also, participants were not involved in the analysis of the observations, timeline surveys and problem ranking exercises of the PRA methodological process (Honkalaskar et al., 2013).

The PRA approach, as used in this study, resulted in an intervention that did not change the existing cookstove design. A twisted tape device was placed in the traditional stove hearth holes to improve heat transfer to the pot and combustion of volatiles. The solution was technological and it had greatest potential for sustained utilisation of the ICS because there was no change in the traditional cooking habits since the stove remained unchanged. However, there was no space created during project implementation to stimulate or enhance users' reflexivity and transformative agency. Community members usually constructed their own stoves once they were broken. In order for them to make the practice of inserting the twisted tape device in the hearth holes sustainable, they needed to continuously maintain hearth dimensions that would fit the twisted tape device every time they replace a stove. This calls for reflexivity and transformative agency. Transformative agency has the potential to enable the users to take initiatives to transform traditional cooking practices (see Chapter 3, Section 3.3).

2.6.2.3 Formative research

Formative research has also been used in ICS intervention programmes. Formative research involves gathering data useful for the development and implementation of intervention programmes (Gittelsohn, Steckler, Johnson, Pratt, Grieser, Pickrel, … Staten, 2006). Programme implementers conduct formative

research to develop effective strategies and communication channels that are important for influencing behaviour change (Corey, 2011). Through formative research, project implementers can identify and understand the characteristics such as interests, behaviours, and needs of an intervention's target population, which influence their decisions and actions (ibid.). Hence, formative research is commonly employed before interventions, as it formulates it (ibid.). It can also be used during a project in order to monitor and evaluate quality of project delivery and capture intended effects and respond to concerns; at the end of a project it can be used to evaluate a project (ibid.). Formative research advocates appropriateness of projects both culturally and geographically (Gittelsohn et al., 2006) and in the development of appropriate study instruments. It also plays a critical role in understanding why certain approaches work and others do not, including what causes an intervention to be successful (Corey, 2011). These are some of the reasons why formative research has been employed in ICS dissemination programmes.

Martin, Arney, Mueller, Kumakech, Walugembe and Mugisha (2013) reported on formative research that was carried out in Uganda, Wakiso district with the purpose to increase the acquisition of and use of a locally fabricated top-lit updraft gasifier (TLUD). It is worth noting that the formative research took place before the introduction of the TLUD. The first phase of the study was exploratory to identify behaviour determinants related to uptake and use of ICS technologies. The results from the first phase informed the design of a behaviour change strategy for the dissemination of the ICS. A workshop organised to develop the behaviour change strategy included some actors deemed key in the ICS technology diffusion in the area and community members. It was intended to collaboratively review the findings from the first phase and develop the strategy by prioritising objectives, identifying motivators and barriers and suggesting target groups, interventions, messages and communication channels (Martin et al., 2013, p. 6930). The workshop employed Visualization in Participatory Programme (VIPP). VIPP is a participatory approach, which encourages participants to work toward a collective agreement (United Nations Children's Fund [UNICEF], 1993). Based on a philosophy of trusting in the capacities and creativity of human beings, it combined techniques of visualisation with methods for interactive learning (ibid., p. 3). VIPP uses a combination of participatory approaches. However, in the description of the ICS programme, Martin et al. (2013) did not clearly explain which aspects of the methodology were employed. Hence, for the purposes of this section, I find it necessary to provide only a brief general review of the methodology.

The central application characteristic of the VIPP method is the role of a facilitator who helps groups to bring out collective ideas, which are visualised on cards and paper of different sizes, shapes, and colours; they are placed on pin boards throughout the group process (UNICEF, 1993, p. 6). Its essence is in bringing together different perceptions and opinions of people as a means to discover new ways of

looking at problems and solutions (ibid., p.34). However, the process of identifying problems and solutions is rapid (ibid.). If applied widely and properly, the VIPP approach has the potential of empowering people at many levels of the development process (ibid., p. 8), particularly through establishing a process of democratisation, which empowers communities and groups at different levels, facilitating dialogue and interaction and leading to local decisions on development actions (p.12). Its design follows five stages: problem analysis, goal setting, sub goal definition, development of a strategy which provides a direction on how the goals and sub goals can be achieved and activity, a delineated action which is part of the overall strategy designed to achieve a given objective or sub goal (ibid.). The major outcome of the method, as well as the measure of its success regardless of objective, is the degree to which the decisions are implemented (UNICEF, 1993; Mohamed, Sulastri, Nur Afni, Sazaroni, Haslina, Maizurah, … & Halilol, 2012).

According to Martin et al. (2013), the outcome of the ICS workshop was the behaviour change strategy, which was subsequently used to design the implementation of the project, which was specifically on the type of intervention and messages intended for specific target audiences within the community.

Formative research, as used in this case, helped to target different segments of the community with different aspects of the intervention based on the problems identified from the first phase. It also helped to tackle some of the barriers to ICS uptake at the beginning before introducing the technology in the community. However, as with most participatory approaches employed in ICS dissemination intervention, one can trace remnants of the top-down approaches. The technology to be disseminated was already decided by the researchers or implementers of the project, based on scientific facts available before the formative research was conducted. It appears that participants were not given a choice on the type of ICS they would prefer. Moreover, the participatory approach adopted seem to have failed to balance between 'participation as a means' and 'participation as an end' (see Section 2.13), while emphasising 'participation as a means'.

2.6.3 Market based approaches

The terms 'business model', 'market-based approach' and 'commercialisation of ICS' are used interchangeably in literature to denote provision of ICS technology and other related services to the adopting communities for a profit. Other approaches blend subsidies (government or donor) and commercialisation. These approaches are referred to as social enterprises or semi-commercial (see Section 2.6.2.1). Most of the ICS programmes reviewed in this section employ market-based approaches but have a social mission to their businesses or rely on some form subsidy.

Commercialisation of ICSs is connected with the shift towards neo-liberal policies, which increased demand from the donor community for stove developers to adopt business-like approaches to stove dissemination (Bailis et al, 2009, p. 1695). According to Hoffman, West, Westley, and Jarvis, as cited in Bailis et al. (2009), stove developers were supposed to be independent and more innovative, efficient, and profitable at what they do as a business (p. 1695). With this paradigm, it was also conceived that uptake of new technologies such as ICSs is improved if end-users pay part of the cost (Barnes & Halpern, 2000; Troncoso et al., 2011). Similarly, it is largely shared among practitioners in the cookstove sector that market-based approaches are a pre-requisite for sustainable and scalable cookstove dissemination (Stove*plus* & GIZ, 2014, p. 13). Shrimali et al. (2011) added that one potential advantage for commercial efforts is that the imperative to make money might lead to a greater focus on matching product attributes to customer needs and desires (p. 7543). Failure to focus on end-user needs and preferences has been identified as one of the barriers to ICS uptake and utilisation as indicated earlier (see also Chapter 1).

The political shift to neo-liberal policies occurred concurrently with the debt crisis of the 1980s when cash-strapped states accepted austerity measures imposed by international financial institutions in order to maintain financial stability (Bailis et al., 2009, p. 1696). Due to the shift, governments cut public spending, sold state investments, lowered or removed tariffs and opened markets to foreign competition (ibid.). One of the consequences of the shift wrought by structural adjustment and neo-liberal policies was the proliferation of civil society organisations, in order to fill the vacuum left by governments' withdrawal, but also in response to market expansion and the effects of the shift on social and environmental stress (ibid., p. 1696). Most civil society organisations were operating with funding from international foundations, NGOs, and donor agencies. However, eventually donors demanded that civil society should adopt market-based approaches, emphasising that "socially or environmentally sound projects or enterprises that fail or remain permanently dependent on subsidy help nobody" (Hoffman et al. as cited in Bailis et al., 2009, p. 1696). Hence, commercialisation of ICSs has been an attempt to shift stove dissemination from civil society to private enterprise (Bailis et al., 2009). As a result, many for-profit initiatives emerged during 1990s (Stove*plus* & GIZ, 2014). In this approach, donors were expected to act more like investors and less like charities (Hoffman et al. in Bailis et al., 2009). The shift was viewed as a way to "scale-up" in order to reach millions of poor households lacking access to clean cooking technologies (Bailis et al., 2009, p. 1694, quote emphasis in original).

Additionally, the push for privatisation and the corresponding increased focus for commercial and market-driven solutions stems from the problems emanating from largely centralised and heavily subsidised ICS programmes (Zerriffi, 2011; Shrimali et al., 2011; Kees & Feldmann, 2011; Stove*plus* & GIZ, 2014). It

was also due to the failure of participatory approaches to bring tangible differences in increasing stove dissemination rates in local communities as well as stove uptake (Sesan, 2014).

There are different business models adopted by different ICS programmes globally which are suited to the contextual environments they are operating in; they vary according to type of initiative implemented, whether NGO supported, social enterprise or private, and on the particular business phase, whether start-up or scale-up (Stove*plus* & GIZ, 2014; Kees & Feldmann; 2011; Shrimali et al., 2011). Most of the programmes are partially subsidised at the initial stages (for example, the Patsari cook stove project under GIRA and CEIco in Mexico, the SZ Consultancy Ltd. GIZ Bangladesh, Enterprise works/VITA Ghana). Most programmes also spend several years when the subsidy model and business model co-exist, before they become fully commercial (Stove*plus* & GIZ, 2014).

Global Alliance for Clean Cookstoves recognised the diversity and proposed a set of questions that can guide clean cooking projects intending to shift to business models (see Box 2.1). The different components have demonstrated different influences to the success of the business models (Shrimali et al., 2011). However, product demonstration as an aspect of marketing strategy has been identified as one of "the most important driver of stove adoption in the marketplace" (ibid., p. 7553). This stresses the need for bringing a large number of people into personal contact with the product to facilitate uptake and potentially, use.

Box 2.1: Guidelines for setting up ICS business models

(1) What are the technology and design choices? Under this question programme implementers need to think about the design priorities they intend to offer to the targeted communities which includes cost effectiveness, fuel efficiency, emission reduction, attractiveness and ease of use. They need to consider technology type, whether natural, forced draft, gasification, and simple combustion; the type of fuel required for the design, for example, raw biomass, processed biomass, charcoal, ethanol, Liquid Petroleum Gas (LPG) or biogas and the manufacturing strategy, whether the stove design will be imported, mass-produced locally or made by artisans.

(2) Who are the target customers? Project implementers need to consider the demographic characteristics of the households in terms of their income, education, occupation, household size and gender; the geographical and regional focus; the dwelling location and type, for example rural, urban, or peri-urban and the competing fuels and cooking methods, such as kerosene, open fire, and/or traditional stoves.

(3) What is the marketing strategy? Project implementers need to consider the product selling points such as cost effectiveness, faster cooking time, and health concerns. They need to think about how they will advertise the product, whether through TV, radio, magazines, internet, word-of-mouth, billboards, and live demonstrations.

(4) What is the channel strategy? Project implementers need to consider the means of building and incentivising a distribution network, the maintenance and after-market support strategies and the means of sourcing fuels if the stove uses processed fuels.

(5) What are the organisational characteristics? Project implementers need to consider the type of organisation they are setting up for the ICS business model, whether it is foreign/multinational company, indigenous company, NGO, or government agency. They need to consider the number of employees available, the experience the management team has; the expected commercial and social returns; whether the products will be sold by the organisation, and if so whether the organisation has experience with products that are analogous to cookstoves.

Source: Adapted from United Nations Foundations (2013-2017)

Evidence shows that commercialisation of ICS can help in scaling up to reach large numbers of end-users with cleaner cooking technologies (Bailis et al., 2009; Shrimali et al., 2011). The few stove programmes that have successfully reached large numbers of consumers have done so through some degree of commercialisation (Bailis et al., 2009; Stove*plus* & GIZ, 2014). The success of business models, however, depends on a number of factors such as well-designed products, well-conceived supply networks, and offering products that consumers want to buy (Shrimali et al., 2011).

Some drawbacks of commercialised models are that it is difficult to reach the Bottom of the Pyramid (BoP) while maintaining a commercially viable operation (Bailis et al., 2009; Shrimali et al., 2011). Commercialised programmes can however reach urban populations, because this segment usually purchases fuels (Shrimali et al., 2011). Another problem of commercialised models is that rigorous follow-up and monitoring for effectiveness may be neglected, particularly if the costs of those activities must be passed on to the consumer (Shrimali et al., 2011). If the prices of the ICS becomes unaffordable to many consumers, then the scale of the stove dissemination will be limited to a relatively narrow market (ibid.). This may defeat the very reason for commercialising the programme in the first place. Focusing on the commercial model may forego many desired health benefits of replacing traditional biomass stoves in the home because a larger population that could benefit from them will simply fail to access it (Shrimali et al., 2011). Another problem is that some projects are typically designed to follow a pre-determined business or delivery model following some standard guidelines and processes (Chaurey et al., 2012, p. 51), and this leaves no room to contextualise the project and the technology for that particular area.

While some business models incorporate the target user and are able to monitor stove usage, many do not. In some instances, the global ICS market only sees the end-users, especially the poor, as consumers or customers to be supplied with the product according to their household energy demands (Sesan, 2014). Technology-and market-led strategies prevalent in the current phase of ICS development reveal little about local priorities as defined by the user themselves (ibid., p. 12).

Some scholars have argued in favour of end-user involvement within the commercialised approaches. Chaurey et al. (2012) remarked that community buy-in and their active involvement from the planning stage is pivotal to ensure the success of the project (p. 49). Again, Kees and Feldmann (2011) argued that engaging people, for example, in the health sector, in order to help them realise the relation of cooking energy to health prevention might help them to react accordingly (p. 7597).

Even with involvement of users in technology design, initial as well as sustained utilisation has been problematic (Troncoso et al., 2011; Bailis et al., 2009; Urmee & Gyamfi, 2014). Some models that have used market-based approaches combined with participatory approaches, have not achieved sustained

utilisation. For example, the Group for Appropriate Rural Technology (GIRA) and the National Autonomous University of Mexico's Centre for Ecosystems Research (CIEco) three-year Patsari stove project in central Mexican highlands relied on user participation to develop the initial stove design, as well as laboratory testing and field validation (Bailis et al., 2009; Urmee & Gyamfi, 2014). This resulted in a family of stoves that were well suited to local cooking practices, saved wood, and reduced indoor air pollution (Bailis et al., 2009, p. 1698). GIRA's technicians also conducted up to three post-installation visits to help customers with difficulties they encountered and this helped in increasing long-term adoption rate (Bailis et al., 2009). However, Patsari adopters did not relinquish other technologies (Bailis et al., 2009), some women had abandoned the stove (Troncoso et al., 2011), many used the Patsari for specific tasks such as those that required a hot surface for a long time (Bailis et al., 2009, p. 1698). One plausible explanation of this may be that the participatory approach employed was technologically driven rather than change-oriented learning that would help to evoke and enhance end users' reflexivity on their daily routines and practices, in order to transform their practices.

At this juncture, literature reviewed seem to reveal that commercialisation may scale-up dissemination, may enable uptake and initial use, yet it does not guarantee sustained utilisation for most of the business models. Moreover, utilisation is not much of concern of some companies because interaction with customers may be minimal to provide customer support (Shrimali et al., 2011).

2.6.3.1 Social enterprise

A social enterprise provides goods or services, but in contrast to traditional businesses, it has a socially-oriented mission that may co-exist with or replace the profit motive (Bailis et al., 2009, p. 1702). It is a "hybrid approach that blends a commercial approach in operations with relaxed requirements on returns in order to fulfil a social need" (Borzaga & Defourny in Shrimali et al., 2011, p. 7544). This approach has been commonly used in a number of ICS technology dissemination programmes (Borzaga & Defourny in Shrimali et al., 2011) compared to pure commercial approaches. In fact, from the literature reviewed, I found one example that employed the pure commercial approach from the onset of the programme, Toyola Energy Limited in Ghana (Stove*plus* & GIZ, 2014). Social enterprises have the potential to scale-up ICS dissemination and sustainability of programmes compared to fully subsidised approaches because they can develop viable supply chains and customer-responsive business models (Shrimali et al., 2011).

A number of ICS programmes have used the social enterprise approach in different regions of the world, such as Latin America, Africa, South Asia, and Asia Pacific. Few examples include, Envirofit India, IcoProDac GERES Cambodia, SZ Consultancy Ltd. GIZ Bangladesh, Enterprise works/VITA Ghana,

Cookswell Jikos Kenya, FAFASO GIZ Burkina Faso, and Enviroft Kenya (Stove*plus* and GIZ, 2014). China and Kenya are the commonly cited examples that have used this approach successfully (Bailis et al., 2009; Shrimali et al., 2011; Stove*plus* & GIZ*,* 2014; Urmee & Gyamfi, 2014; ESMAP, 2015). China's National Improved Stove Programme (NISP) initially combined a central push with some profit-oriented components to create functioning markets for stoves and slowly progressed into fully commercial operations (Bailis et al., 2009; Shrimali et al., 2011). NISP is the only cookstove dissemination programme to achieve broad success at scale, with most of the stoves disseminated remaining in use over a long period of time (Shrimali et al., 2011; Bailis et al., 2009). NISP stretched from the early 1980s until the late 1990s in three distinct phases and each phase involved a shift toward increasing commercialisation (Bailis et al., 2009, p.1700). The first phase received a subsidy from central government and counties, but consumers paid the largest fraction of the stove's cost (ibid.). In the second phase, "consumer subsidies were rapidly scaled back in favour of commercialisation and businesses were assisted with tax breaks and favourable loans" (ibid.) In the third phase, the "state's support shifted to technical advice, and to setting standards and offering certification to ensure consumer confidence in new designs" (ibid.).

Another programme that combined government and/or donor support and commercialisation is the Kenya Ceramic Jiko (KCJ). The KCJ was originally developed with funding by USAID in the early 1980s, and over time, it developed into a commercial approach (Bailis et al., 2009; Shrimali et al., 2011). KCJ was designed in partnership with local and outside technical experts in the development stages, such as design and testing, and it benefitted significantly from aid groups and local women's organisation inputs (Bailis et al., 2009). The project then moved its focus to enterprise development and trained skilled artisans in the country, training of technical assistance and public education, a marketing programme and quality control certification (ibid.), among other things. It continued receiving sustained funding for up to eight years (ibid.). The KCJ has gained wide popularity within Kenya and Sub-Saharan Africa because of several factors. However, the most important factor is that it uses charcoal, which is primarily an urban fuel (ibid.). For example, in Malawi, among the population that can afford electricity; due to persistent power outages, many people use KCJ. In the urban settings, consumers are also used to purchasing both fuels and stoves different from rural areas where households rely on firewood and other fuels, which in most cases they do not buy; they also make their own traditional stoves (ibid.).

Another example is the Ugandan Energy Saving Stove project implemented by the GTZ on behalf of the German Federal Ministry for Economic Development and Cooperation. According to Kees and Feldmann (2011, p.7598), it was co-funded by the Dutch government and part of the wider Ugandan-German Promotion of Renewable Energy and Energy Efficiency Programme (PREEEP). The project started at the end of 2004 in Bushenyi District and expanded into other districts. All activities were carried out in

strong cooperation with the Ugandan Ministry of Energy and Mineral Development (MEMD). By 2005, around 500 000 households in Uganda had started using the energy saving rocket stoves. At that time, this rate of dissemination was the first to be reached among African countries in such a short period (ibid.). The reasons for the success included: (1) A convenient, modern, and affordable technology; (2) A dissemination approach that involved training local artisans, using local materials, employing local service providers and NGOs for training and promotion campaigns which helped in strengthening local value chains; and (3) An intensive monitoring system from the beginning that guaranteed product quality and a political system that acknowledged the relevance of efficient and modern cookstoves and supported a massive scaling-up by setting clear targets (pp. 7598-7599).

However, according to Bailis et al. (2009), even though the experiences of China, KCJ and Uganda demonstrate that it is possible to attain large-scale ICS dissemination by shifting from donor-supported models to commercial models, the transitions occurred for specific types of technologies and under particular conditions that may not exist everywhere (p. 1700). In general, successful scale-up has been limited (as indicated in Chapter 1) and contextually distinct where it has been successful, hence it is difficult to draw generalisable conclusions (ibid., p.1701).

On the other hand, other programmes have failed to succeed due to ill-conceived business models and inattention to financing realities, for example, in Nepal (Chaurey et al., 2012). "The Limited success was largely ascribed to the fact that there was insufficient promotion, education, monitoring, and follow up" (United Nations in Chaurey et al., 2012, p. 49).

Market-based approaches as employed in the ICS programmes underline the importance of awareness raising about the technology as one of the key elements in project success (Rehfuess et al., 2014; Stove*plus* & GIZ, 2014; Kees & Feldman, 2012; Chaurey et al., 2012). Awareness raising is done through television, village promotions/community promotions, live demonstrations and end-user education on the benefits of the ICS (Stove*plus* & GIZ 2014). Awareness raising and user education mainly focuses on the benefits of the stoves. This is because they employ social marketing as a strategy for reaching out to end-users, which has its roots in advertising and marketing strategies (see Section 2.12) However, this becomes problematic if the marketing strategy does not comply with the practical use of the technology. For example, where the stove is marketed as convenient in terms of speed in cooking and yet this is not realised in the real-world situation. Rehfuess et al. (2014) warned about using coercive approaches based on deliberate misinformation or false promises, as they are likely to lead to rejection of the technology, despite initial uptake (p. 126). Further, awareness raising and end-user education is often directed at

end-users and leaves the other actors outside of the learning process, as it is often assumed that these other actors may not need learning in their activities.

Literature reviewed on market-based approaches reveal limitations in terms of engaging end-users to reflect on their practices or enhance reflexivity in their continued use of traditional open fires. Further, end-users are not engaged in defining the object of their activity and their outcomes for engaging in the ICS cooking activity, which could potentially help shape the direction of their efforts, enhance reflexivity, and evoke transformative agency (see Chapters 3, 7 and 8). Instead, it appears that the implementing agents define and impose the object of end-user activity, which, as argued earlier, is the influence of top-down approaches. This lack of focus on 'object-oriented ICS project activity' seems to affect sustained use of the technology. While other programmes have succeeded in getting the users to use the ICS, and the success is mainly attributed to awareness raising, for example, the Ugandan case project, some cases have reported stacking of devices and abandonment even with awareness raising, for example, Patsari stove project (Bailis et al., 2009; Troncoso et al., 2011), as indicted earlier. Many examples also provide evidence of stacking (Ruiz-Mercado & Masera, 2015; Bielecki & Wingenbach, 2014), as also noted above.

In summary, learning oriented approaches to cook stove innovation dissemination that focus on enhancing reflexivity and evoking and supporting transformative agency after project initiation are seemingly absent in the three dominant approaches to ICS dissemination. Most of the learning embedded in the awareness raising is informative rather than transformative learning (see Chapter 3, Section 3.4.5). Moreover, in some projects raising awareness is a once-off activity, especially community level awareness. In some commercial approaches, awareness is not an area of great investment because companies are trying to avoid costs (Stove*plus* & GIZ, 2014). Moreover, most participatory approaches reviewed revolve around the delivery of technological solutions as the main project's outcome.

2.7 Dominant dissemination approaches in Malawi

As already pointed out (see Section 2.2.2) in the early ICS dissemination initiatives around 1980s, Malawi, like other countries relied on centralised service delivery mainly focusing on self-help approaches or free stove distribution by government (Kees & Feldman, 2011). From that time on, different programmes have used a combination of dissemination approaches with no specific period that can be clearly demarcated. A good number of programmes have used and continue to use market-based approaches of some sort, which usually employ comparative demonstrations of use between the TSF and the ICS disseminated (Concern Universal, 2012). A few examples of projects that have used this approach are Mountain Biodiversity Increases Livelihoods Security (MOB-LISE), Aleva and Concern Universal programmes.

Another dominant dissemination approach is the charitable scheme where volunteers build the stove free but beneficiaries contribute labour and materials (ibid.) depending on the model and approach adopted by the implementing institution. Examples include: Peace Corps, Project Concern International, and Esperanza Estate with GIZ and CADECOM. Another variant of the charitable scheme is free distribution of stoves, which has continued in some programmes recently. In some cases, implementing institutions have used the approach at the beginning of a project and later introduce other models. For example, in Chapita case study, Concern Universal had distributed free stoves around 2009, but later on with the initiative from some women in the community, it introduced a social enterprise model. Concern Universal also distributed free stoves around 2015 in Balaka and other beneficiary districts under a Social Cash Transfers project called "The Malawi Mtukula Pakhomo" (Chisoni, 2016c), in the vernacular language, which translates to "empower a household". There have also been participatory approaches (see Section 2.6.2.1). However, the problem is that there is little documentation of stove programmes in Malawi. Below I provide examples of the dominant approaches as employed by implementing institutions from the study.

2.7.1 CADECOM charitable Scheme

CADECOM employed the charitable scheme for the fixed-mud stove in Waziloya Makwakwa. The implementers provided free training for stove construction. As indicated in Chapter 1, potential stove users collect all stove construction materials, and request the volunteers who were trained in stove construction to build them a stove. The volunteers find a date to construct the stove, then after 14 days, when the stove is dry they go and open it, fix any developing cracks and hand it over to the end-user. The charitable scheme works very well, except that there is lack of communication between the project implementers and the producers on why stove constructors are not supposed to charge for stove construction (see Chapter 6, Section 6.4.4.1). This problem stems from top-down approaches where producers were not informed of the underlying reasons for adopting a charitable dissemination approach.

2.7.2 Concern Universal's social enterprise

Concern Universal employed a social enterprise dissemination approach in the two case studies Chapita and Chilije. The organisation uses indirect subsidy (see Section 2.7), which is directed to the supply side. It trains trainers and pays them for training production groups. Additionally, production groups receive free training. Sometimes, Concern Universal provides transportation of stoves to stove markets/buyers. Producers pay the cost for transportation indirectly by reducing the price of the stove, which they sell to the promoter at a wholesale price. During the study period, producers were selling the stove to end-users and promoters at MWK500 (US$0.70)[22] each, while promoters were selling the same stove at MWK600

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[22] All the conversions were based on January 2018-conversion rate, US$1.00 = MWK7.13.44. MWK = Malawi Kwacha, US$ = USA dollars.

(US$0.84) to other buyers. In urban retail shops, it was sold at MWK2000 (US$2.80). Concern Universal also used a technological solution as a financing option (see Section 2.9). The stove was designed to be cheaper to facilitate affordability and access (see Chapter 1). The price at which the producers sell the stoves is determined by the implementing organisation, yet without the involvement of the producers (see Chapter 6, Section 6.3.2.5 and Chapter 8, Section 8.2.1.2) – a clear top-down fashion to ICS dissemination processes. To reach out to end-users, Concern Universal uses social marketing strategies, through open days, cooking demonstrations, road shows and DJs that go around communities to inform end-users of the benefits of ICS and its relation to climate change (Field Facilitator LM, interview # BK11).

2.8 Subsidies

According to Stove*plus* and GIZ (2014), subsidy may refer to any contribution direct or indirect, public, or private that reduces the cost of stoves to end-users (p. 22). Indirect subsidies may be invested in the value chain such as training producers, quality control measures, and other activities to scale-up production, while direct subsidies may be used directly to reduce the price of the stove (ibid.). This may allow more consumers to purchase the product (ibid.). Hence, subsidies play a very important role in developing cookstove markets; as such, they have been a major aspect of both centralised delivery and commercialised models (Stoveplus & GIZ, 2014). Subsidies have been applied for cooking and heating fuels and donations of technologies to benefit both consumers and producers (Zerriffi, 2011). Subsidies also act like solutions to problems with willingness to pay and ability to pay (Bailis et al., 2009). As such, both implicit and explicit subsidies have been a major component in keeping energy access affordable to consumers in developing countries (Zerriffi, 2011, p. 273).) They are needed to serve the neediest of the populations because it is difficult for commercial business models to make a profit while serving this group of people (Shrimali et al., 2011). Since the most important concern of the business models has been to sustainably manage the business and scale-up ICS, subsidies have a played a role on both supply and consumer side. Consequently, in ICS dissemination, subsidies have been identified as one major enabler to stove uptake especially with upfront entrepreneurial capital for stove business development (Rehfuess et al., 2014).

Early efforts to disseminate cleaner and more efficient cookstoves to those at the Bottom of Pyramid (BOP) in developing countries were mostly subsidised through Official Development Assistance and development programmes (Stove*plus* & GIZ, 2014, p.10). A few examples of programmes that have used subsidies include IcoProDac GERES in Cambodia, SZ Consultancy Ltd. GIZ Bangladesh, Envirofit India, FAFASO GIZ Burkina Faso, EnterprizeWorks/ VITA in Ghana, Toyola Energy Ltd. in Ghana, Envirofit Kenya, Concern Universal in Malawi, amongst others.

On the other hand, subsidies may have negative sides to ICS dissemination depending on how they are administered (Stove*plus* & GIZ, 2014). For example, subsidised fuels have been poorly targeted or even diverted from their intended recipients, benefiting those who were never intended as targets of the subsidy programme and creating huge losses without necessarily providing attendant welfare gains (Zerriffi, 2011, p. 273). The results of largely centralised and heavily subsidised programmes have generally been disappointing, as evidenced by the remaining population that needs to be served (ibid., p. 273). Sometimes, subsidies are market destroying rather than enhancing (ibid., p. 276). As a promotion strategy, subsidies may be risky; high subsidies have been attributed to the failure of the Indian government stove programme (United Nations Development Programme [UNDP], in Urmee & Gyamfi, 2014; Rehfuess et al., 2014).

2.9 Financing models

Financing models have been used in both pure commercial or semi-commercial models to facilitate production of ICS, as well aid access to end-users. There are two dominant types of financial models: the producer side and the consumer side models. The producer side models are also called enterprise financing that may cover the entire supply chain from manufacturing through distribution (Zerriffi, 2011). This type of financing helps in attracting initial investments for projects and financing dealers and distribution networks depending on the core components of the business models (Zerriffi, 2011, p. 274). For example, IcoProDac GERES Cambodia used a built-in credit facility which provided small loans to its members, including wholesalers, distributors and retailers, while EntrepriseWorks VITA offered a loan system for value chain actors (Stove*plus* & GIZ, 2014). Consumer financing is a viable option to increase stove sales (Shrimali et al., 2011), at the same time allowing a majority of the population to access the technology. A number of options have been employed on the consumer side to provide financing for new energy services and technologies directly to the consumer allowing them to overcome their first-cost problems (Zerriffi, 2011, p. 274). These options all rely on the granting of credit in some form to consumers so that the initial burden of the technology is spread out over time (ibid.). There are several financing options including: (1) **direct finance option**, which involves a number of options. Those that apply to ICS include where the energy technology provider extends credit directly to the consumers. This may include splitting purchase payments into multiple payments or differing payments into the future. For example, Toyola Energy Limited (Ghana) used a customer payment system, which allows customers to pay in instalments, usually three payments over a month (Stove*plus* & GIZ 2014, p. 46). (2) **Third-party financing,** where consumers finance their access by relying on third party financing, such as the revolving funds set up by donors; or using micro credit facilities to purchase the technology (Zerriffi, 2011,

p. 275). Another common option is a **technological solution**, which involves changing the technology itself to make it affordable (Zerriffi, 2011, p. 275) or rather coming up with an initial low-cost design (e.g. Chitetezo Mbaula and the mud fixed stove in Waziloya Makwakwa).

Carbon finance has also been used in financing energy access (Shrimali et al. 2011). Depending on the structure of the model, carbon credits have been used to either solve the enterprise financing or consumer financing problems or both and this is seen by some as a vehicle for solving multiple problems at once (in particular, given the potential to provide both climate and health co-benefits) (Zerriffi, 2011, p. 275). Carbon finance for cook stoves has become popular and various carbon-offset mechanisms have been used for this purpose, such as voluntary offsets and the Kyoto Protocol's Clean Development Mechanism (CDM, 2008 in Shrimali et al., 2011, p. 7545; Stoveplus & GIZ, 2014).

The mechanisms highlighted above facilitate stove uptake, and not necessarily utilisation, whether initial utilisation or sustained utilisation.

2.10 Social marketing strategy as employed in ICS promotion

In addressing environmental, public health and agricultural challenges, practitioners have used social marketing in which state or donor support has raised awareness about a problem and suggested purchase of goods (Waisbord, 2001; Bailis et al., 2009) with the goal to change people's behaviours and reduce impacts associated with the problem (Bailis et al., 2009, p. 1701). Social marketing has been used especially in developing countries in many interventions (for example, ICS adoption, condom use, breast-feeding and immunisation programmes) and in the United States, in protection of forests, smoking, alcoholism, seat belt use, and so on (Waisbord, 2001, Andreasen, 1994; Smith, 2006). Social marketing relates to activities rather than entities that a social entrepreneur uses to promote the goals of the social enterprise (Bailis et al., 2009, p.1702).

The use of a social marketing approach to promote social goals was first introduced in the 1950s (Wiebe, 1951 in Bailis et al., 2009) but it only attracted considerable attention around 1970 (Kotler & Zaltman, 1971 in Bailis et al., 2009, Waisbord, 2001; Andreasen, 1994). During this time, it was one of the most influential strategies in the field of development communication (Waisbord, 2001). Social marketing originated out of the need of marketing to expand disciplinary boundaries, to be socially relevant and socially responsible, to be sensitive to social issues and to strive towards the social good (Andreasen, 1994; Waisbord, 2001). Additionally, it was seen as an intervention tool for organisations whose businesses promoted social change (Waisbord, 2001). The central premises of advertising and marketing

disciplines underlines social marketing, i.e. the goal of an advertising/ marketing campaign is to make the public aware about the existence, the price and the benefits of specific products (ibid., p. 6).

Social marketing carried forward the premises of diffusion of innovation and behaviour change models, suggesting that the emphasis should be on influencing behaviour and not on getting ideas out or transforming attitudes (Waisbord, 2001; Andreasen, 1994). This conceptualization understands communication as persuasion, emphasising the transmission of information and a top-down approach to influence change (Waisbord, 2001; Kotler & Roberto in Andreasen, 1994). In its standard definition, social marketing entails a process, a chain of activities that the social marketer completes. "Social marketing is the design, implementation, and control of programs calculated to influence the acceptability of social ideas and involving consideration of product planning, pricing, communication, distribution, and marketing research" (Kotler & Zaltman, 1971 in Waisbord, 2001, p. 7). However, Andreasen (1994), with the intention to emphasise the bottom line of social marketing, i.e. the *influence on behaviour* (italics my emphasis) defined social marketing as "the adaptation of commercial marketing technologies to programs designed to influence the voluntary behaviour of target audiences to improve their personal welfare and that of the society of which they are a part" (p. 110). According to Andreasen, the emphasis on behaviour change helps to avoid evaluating programmes' success in terms of quantifiable facts, which is usually a tendency among social marketers who do not emphasise the bottom line of social marketing (ibid.). For example, this has been the tendency in ICS dissemination, to judge success of ICS projects by the number of stoves sold or distributed.

Social marketing intends to reduce the psychological, social, economic and practical distance between the consumer and the behaviour (Wallack et al., in Waisbord 2001 p. 7). Hence, it strives to make the product affordable, available and attractive (Steson & David, in Waisbord, 2001).

One criteria of social marketing proposed by Andreasen (1994) is design of strategies to effect behaviour change, which comprises four elements of marketing mix; these include product, place, price and promotion (the four Ps) (p. 112). In my review of literature on ICS dissemination, place, price, and promotion have been generally considered with varying degrees in different programmes in different parts of the world. However, in many ways and in general, ICS programmes have had problems to fully consider "product", the ICS technology – its uptake and use. Product is the behaviour to be promoted, which requires it to be fully responsive to the target consumers' needs and wants; it has to be easy and satisfying (ibid., p. 112). Andreasen (1994) also observed that other programmes have a tendency to focus only on promotion and fail to do anything about the other Ps, which becomes a problem with social marketing in

practice. This is also the case in some ICS dissemination programmes. In addition, ICS programmes tend to emphasise any one of the four Ps, depending on the model adopted.

In the case that there is resistance to achieve desired behaviour, the task of social marketing is to sort out cultural beliefs that may explain why people are unwilling to engage in certain practices, even when they are informed about the positive results of the new technology (Waisbord, 2001). For example, where people are experiencing firewood scarcity and are provided with a free ICS that reduces the consumption of firewood, but continue to use the TSF, which consumes firewood. Social marketing theorises that knowledge about cultural beliefs forms the baseline that allows positioning of a product, and that a product needs to be positioned in the context of community beliefs (Waisbord, 2001, p.7).

"Aspects" of social marketing have been employed in the promotion of ICS to raise awareness of the technology, its benefits, and the links between indoor air pollution and climate change. I emphasise "aspects" here because, in some programmes, practitioners have concentrated only on the communication aspects of social marketing such as awareness raising or emphasised other aspects deemed important in their context without capturing the full concept of social marketing in practice. For example, activities such as market research, distribution networks (see Chapter 1), social-cultural beliefs research of the targeted population (Bielecki & Wingenbach, 2014), and specific formative research appear to have limited emphasis. Andreasen (1994) also made similar observations, where some social marketing programmes have focused only on providing information without considering whether the activities would lead to the desired behaviour.

In ICS practice, social marketing strategy appears to be employed with little regard for socio-cultural beliefs around cooking traditions. This is evidenced from the many studies that reveal technology and design factors that fail to consider socio-cultural requirements of the adopting communities (see Rehfuess et al., 2014, pp. 123-124). This appears to be related to the top-down approaches dominating ICS practice. As Fox, in Waisbord (2001), observed, around the 1960s the social marketing approach encountered problems in terms of the effectiveness of its applications, specifically due to the motives of the sponsors (p. 8). Sometimes however, social marketers themselves reduce their programme's effectiveness because their comprehension of the social problems is biased through their mental models (Wymer, 2011, p. 17). The socio-cultural factors around cooking and heating activities have been identified in many studies to constrain utilisation of ICS technology (Rehfuees at al., 2014; Bielecki & Wingenbach, 2014).

ICS programmes have used different ways to raise awareness of the technology, for example, television, radio, live demonstrations on the performance of the ICS, newspapers, DJs, roadshows, billboards,

market days promotions, songs and opinion leaders (Stove*plus* & GIZ, 2014; Shrimali et al., 2011; Concern Universal, 2012). Some of these ways raise adoption rates or create demand such as via opinion leaders (Malhotra et al., 2004; Feder & Savastano, in Shrimali et al., 2011; Jagger & Jumbe, 2016), for example, village chiefs (Feder & Savastano, in Shrimali et al., 2011; Malhotra et al., 2004). Similarly, live/cooking/comparative demonstrations and word of mouth raise adoption rates (Concern Universal, 2012; Jagger & Jumbe, 2016).

One of the main strengths of social marketing theory is that it allows the positioning of products and concepts in traditional beliefs systems (Waisbord, 2001, p. 9) with its emphasis on in-depth research of targeted populations (ibid.). It centres on awareness raising for the existence, price and the benefits of specific products. A number of companies have identified awareness raising as an important aspect for marketing their ICS technology and scaling-up uptake (Stoveplus & GIZ, 2014). As such, social marketing is important, especially in the early stages of ICS innovation diffusion where actors require understanding the new technology. Social marketing has provided important information necessary for ICS uptake for many programmes.

However, social marketing is limited to informative learning (see Chapter 3, Section 3.5.1), for it places less concern on transforming attitudes that may be required for initial as well as sustained utilisation of ICS technology. Hence, the limitation of social marketing approach is the failure to influence transformative learning in and among ICS actors. From the literature reviewed, generally, the employment of social marketing strategies in ICS intervention has so far demonstrated failure to influence sustained utilisation of the technology and, in some cases, even initial use. Of course, some cases provide evidence of initial use (DeWan, Green, Li & Hayden, 2013). This resonates with Agarwal who, more than 30 years ago in a study on ICS diffusion, expressed limitations of market-oriented approach promotions to influence acceptance of the ICS innovation (Bielecki & Wingernbach, 2014).

2.11 Implications of the dissemination models: A summary

In the diffusion of innovations, Rogers (1983) proposed two innovation diffusion systems, the centralised and decentralised. The centralised diffusion system is based on one-way flow of communication from experts. An innovation originates from expert sources that diffuse the innovation as a uniform package to potential adopters who accept or reject the innovation; the adopter takes the role of a passive accepter (ibid.). The technical expert officials make key decisions about which innovations to diffuse, how to diffuse them, and to whom they diffuse them (p. 333). In the decentralised diffusion systems on the other hand, all members of the diffusion system share information to reach an understanding and participate in

designing and implementing an innovation (p. 346). Adopters are involved in decision-making, and in many ways, they serve as their own change agents (p. 334). Table 2.2 below illustrates the difference between the centralised and the decentralised diffusion systems focussing on six major points.

Table 2.2: Characteristics of centralised and decentralised diffusion systems

Characteristic of diffusion system	Centralised diffusion system	Decentralised diffusion system
1. The degree of centralisation in decision-making and power	Overall control of decisions by national government administrators and technical subject matter experts	Wide sharing of power and control among the members of the diffusion system; client control by local community officials/leaders
2. Direction of diffusion	Top-down diffusion from experts to local users of innovation	Peer diffusion of innovations through horizontal networks
3. Sources of innovations	Innovations come from Research and Development (R&D) conducted by technical experts	Innovations come from local experimentation by non-experts who often are users
4. Who decides which innovation to defuse?	Top administrators and technical subject matter experts make decisions about which innovations should be defused	Local units decide which innovations should diffuse based on their informal evaluations of the innovations
5. How important are clients' needs in driving the decision process?	An innovation centred approach; i.e. technology push emphasising needs created by the availability of the innovation	A problem-centred approach i.e. technology pull, created by locally perceived needs and problems
6. Amount of reinvention	A low degree of local adaptation and re-inventions of the innovations as they diffuse among adopters	A high degree of local adaptation and re-inventions of the innovations as they diffuse among adopters

Source: Rogers (1983, p. 335)

In Table 2.2, centralised diffusion systems are characterised by top-down approaches. It appears that centralised diffusion systems are prevalent in ICS dissemination approaches. Evidence from the reviewed literature shows that if we put the ICS dissemination approaches on a continuum: (1) centralised delivery system would be on the extreme end of centralised diffusion system; (2) market-based approaches would be closer to the centralised diffusion system, further away from decentralised diffusion systems; and (3) participatory approaches as employed in the ICS practice 'probably' in the middle of the continuum.

Participatory approaches were introduced as a move towards decentralised diffusion systems. However, as it shall be argued below, in practice it failed to strike a balance between participation as a "means" and participation as an "end". It can be argued therefore that top-down approaches are a predominant characteristic running through the three dominant approaches to ICS dissemination. Sesan (2014) contended that

a review of the trajectory of improved stove development over three successive… phases … suggests that, despite the rhetorical move towards more context responsive implementation

approaches, the priorities and policies of outsider actors appear to take centre stage in the current market-based phase of stove development just as much as they did in the first expert-led phase of the 1970s. (p. 14)

Sesan continues to elaborate that even though ICS development practitioners embraced "participatory development principles from the second phase of stove development onwards, the perceptions and perspectives of local citizens continue to be relegated in practice well into the third phase" (p.15). Most of the approaches adopted for ICS have remained top-down and focused essentially on tangible technical objectives (Honkalaskar et al., 2013, p. 3). "Agencies involved in ICS projects usually have bureaucratic, power-conscious, performance-driven, and goal-oriented structures" (ibid., p. 3). Parfitt (2004) added that although most agencies adopted participatory methods, they adhered to traditional top-down power relations. Power relations between aid donors and recipients remain essentially the same as in traditional top-down models of development (Parfitt, 2004, p. 539). Outsider agencies have continued to gain control over programme input and consequently promote outcomes that serve to advance development objectives pre-set by powerful 'extrinsic' donor agencies (Simon, in Sesan, 2014, p. 5). For example, as Troncoso et al. (2011) noted, communities usually never demand stove construction, ICSs are constructed as a solution to a problem detected by implementers. Moreover, implementers promote one type of stove in a community (Ruiz-Mercado & Masera, 2015) without providing potential users a choice.

Essentially, detection of problems by implementers may not present the whole problem here, it seems that the problem emanates from lack of balance between centralised and decentralised diffusion systems. Rogers (1983) argued that, in reality, an actual diffusion system usually combines some of the elements of centralised and decentralised diffusion systems (p.335) and that a heavy weighting of each system may depend on circumstances and the issue at hand (Waisbord, 2001).

Similarly, the problem emanates from a lack of balance between participation as a means and participations as an end. According to Parfitt (2004), participation must function as both a means and an end. This is because any development project must produce some outputs, in which case, participation is seen as a means to achieve such outputs. At the same time, it must also empower stakeholders; in which case empowerment is viewed as a necessary outcome (p. 537). Parfitt reckoned that this ambiguity becomes contradictory when emphasis is laid on participation as a means at the expense of participation as an end (p. 537).

The practice of participation has been critiqued by a number of authors, especially its emancipatory claims, because it does not empower those at the grassroots. Agencies simply provide alternative methods for incorporating the poor into the projects of large agencies yet they remain unaccountable to them (Parfitt, 2004). Participation is simply another means of pursuing traditional top-down development

agendas, while giving the impression of implementing a more inclusive project of empowering the poor and the excluded (pp. 537-538).

In my review of literature on dissemination approaches to ICS (as illustrated above), participation has been employed more as a means, because implementers and donor agencies have concentrated on obtaining quantifiable outputs of devices implemented and generally on scaling-up rather than on empowering the end-users and sometimes the rural women producers, where the rural poor women do production. As discussed above the reasons for the shift from centralised to participatory approaches to market-based approaches were to efficiently and successfully scale-up delivery and adoption, which is a manifestation of participation as a means. According to Parfitt (2004), when the inducement persuading development agencies and practitioners to embrace participatory approaches (or shift to other approaches) is the increment that the approaches would give to efficiency, this is an example of focusing on participation as a means. Parfitt emphasised,

> … this resort to a discourse of participation as means effectively re-inscribes the primacy of a top-down logic of the need to achieve measurable objectives efficiently. Thus, power re-enters the equation incognito under the guise of the demands of efficiency. (p. 544)

As noted by Oakley in Parfitt (2004), government and development agencies see participation as the means to improve the delivery systems of the projects they seek to implement (p. 540). This means that they are prone to regard participation as a means, although many of them still give at least rhetorical attention to the objective of empowerment (Parfitt, 2004, p. 540).

2.11.1 Implications of top-down approaches on uptake and utilisation

Literature reviewed on the dissemination approaches, indicates that the dominance of outsider stakeholders in the ICS practice and the top-down approaches related to this dominance is one of the major reasons for the failure of many improved cook stove programmes (Sesan, 2014; Honkalaskar et al., 2013; Sesan, 2012; Simon, 2010; Troncoso, Castillo, Masera & Merino, 2007; Barnes et al., 1993). Similarly, even with participatory inputs from end-users in some ICS programmes, outcomes have not been favourable in many projects (Honkalaskar et al., 2013) because of the remnants of the expert-driven top-down approaches (Sesan, 2014). In such programmes, the design of ICS is mainly driven by ideas, concerns and information from external actors while turning a deaf-ear to actual users' perception (Troncoso et al., 2007). For instance, findings from the case study that used the adaptive management approach as reported above (see Section 2.6.2.1) reveal that the NGO's work in the implementation of the programme was constrained by the need to meet their commitment to sponsors (Troncoso et al., 2011, p. 7600). There were issues to do with time pressures to accomplish the commitment of building a set number of stoves in the three years of the project (p. 7604). As a result, the project failed to consider

the opinions of the users and the only option left was to find ways of convincing the users in order to win them over (ibid.).

Nevertheless, evidence shows that programmes using top-down approaches and relying on donor funding to subsidise the stoves, have performed much worse than programmes that have employed participatory approaches from the beginning and in which funding was used to establish a self-sustaining stove industry (Barnes et al., in Urmee & Gyamfi, 2014; Bailis et al., 2009). For example, the top-down approach adopted by the Indian NPIC contributed to its failure; it was implemented country-wide, resulting in dispersion of efforts and dilution of financial resources (Urmee & Gyamfi, 2014, p. 634). Yet, as discussed above (see section 2.6.2.1), the NISP Chinese programme is an example of a success story that adopted a self-sustaining market-based approach. Taking into account user needs may therefore contribute to the success of a programme (Urmee & Gyamfi, 2014) especially when it emanates from community involvement, from identification of suitable stove design to stove distribution, because it creates a greater sense of ownership (Rehfuess et al., 2014).

In summary, top-down approaches have succeeded in scaling-up stove programmes, uptake and initial utilisation of the ICS in other parts of the world (such as Mexico, India, and Malawi, to mention a few) but have failed to facilitate "sustained" utilisation in most programmes globally.

2.11.2 Limitations of the approaches in relation to a learning-oriented study

The limitation with the dissemination approaches is the degree to which they have failed to empower local communities and let them gain control over the ICS projects. Precisely, *reflexivity* and *transformative agency*, including *enhancement of interaction* of *all* key actors are overlooked, or put differently, are not the focus in the three dominant approaches. Despite the shift taken by participatory approaches towards a decentralised diffusion system through involving stakeholders, especially women in varying degrees and in various ways, the three core elements of learning for sustainability of practice (see Chapter 3, Sections 3.3, 3.4.1 and 3.4.2) were not the main outcomes of the learning processes of the programs (see Section 3.5.1).

Participation implies that stakeholders are involved, empowered, and take control over the development initiative (Honkalaskar et al., 2013). This, as indicated in Chapter 1, is consonant with the theories, approaches and methodologies employed in this study (see Chapter 3). Participation in this study not only strikes a balance between "means" and "end" but goes beyond, since learning is an ongoing activity (see Chapters 7 & 8), particularly when rooted in evoking and supporting reflexivity and transformative agency (as argued elsewhere) among participating individuals and communities (see Chapters 7 and 8). The learning processes employed in this study focus on evoking transformative agency and reflexivity in

research participants and enhancing interaction, which are seen as a form of empowerment towards its emancipatory agenda.

2.12 Analytical frameworks of ICS programmes

According to Bailis et al. (2009), research on ICS has focussed largely on technical aspects of stoves such as efficiency, emissions, and pollution exposures, citing studies such as Berrueta, Edwards and Masera (2008); Ezzati et al. (2004); Simon et al. (2004) and Smith et al. (2007). They also noted that some studies have examined large state-sponsored distribution efforts citing Aggrarval and Chandel, 2004; Barnes and Kuma, 2002; Kishore and Ramana, 2002; Sinton et al., 2004; Smith, Shuhua, Kun, and Daxiong, 1993) (Bailis et al., 2009). Apart from these, various other studies (see Section 2.5), using different conceptual frameworks, have sought to understand and describe the transitions from traditional cooking technologies to ICS technologies. A number of theoretical frameworks have also been used to analyse existing ICS programmes in order to inform the ICS practice in different ways.

Of these theoretical frameworks, a good number are based on the significance of considering the user environment in the diffusion process. As generally accepted in literature on adoption of ICS technology, the degree to which the end-user is involved in the ICS diffusion process and particularly in the design stages is significant in determining the end-user uptake of the ICS and/or continued use of it (Chaurey et al., 2012; Kees & Feldman, 2011; Agarwal, 1983). In addition, the innovation systems approach aspires to understand the processes underlying ICS innovation diffusion (Agbemabiese, Mkomo & Sokona, 2012; Atteridge et al., 2013). Specifically, it is the need for analysing both the interaction between structural and process/function elements in a Technological Innovation System that is deemed important for understanding determinants of change (Bergek in Atteridge et al., 2013; Bergek et al., 2008; Atteridge et al., 2013; Geels, Schwanen & Sorrell, 2015). As indicated in Chapter 1, interaction between these elements is one of the foci of this study and is one way of facilitating learning in ICS practice (see Chapter 3, section 3.4.2).

Lundvall in Agbemabiese et al. (2012) contended that innovation primarily entails a learning process. Innovation involves a recombination of knowledge already in existence and the creation of new combinations of knowledges (Schumpeter in Agbemabiese et al., 2012). These kinds of learning processes centrally require contributions from multiple actors to exchange knowledge (Lundvall in Agbemabiese et al., 2012). Brew-Hammond in Agbemabiese et al. (2012) echoed the importance of learning in innovation diffusion, emphasising the importance of informal learning schemes, and called for stakeholders to facilitate learning-based relationships among key actors in processes that contribute to innovation and technology development.

Literature reviewed in the context of this study, however, reveals a gap in change-oriented learning (or learning-centred) approaches to ICS technology diffusion processes and analysis of existing programmes. In particular, I have found a huge gap on theoretical/analytical frameworks that foreground 'reflexivity' and 'transformative agency' as key in learning for sustainability and transformation of the ICS practice.

Below I review some theoretical frameworks that posit *interaction*[23] used to analyse ICS programmes. I have briefly reviewed Diffusion of Innovation, Social Network Theory, Strategic Niche Management, and Dual Adoption Framework in Table 2.3 that follows. In the next section, I concentrate on Socio-Technical Systems (STS) in order to highlight common features it shares with Cultural Historical Activity Theory (CHAT), as well as differences, which explains why I opted for CHAT to understand the ICS practice in Malawi and to potentially inform sustained uptake and utilisation of the ICS technology.

Table 2.3: Theoretical and analytical frameworks used in ICS innovation programmes

Theory/Analytical Framework	Theory description, focus and application in ICS programme analysis
Diffusion of Innovation (DOI)	DOI theory assumes a linear progression of aspects leading to adoption of a technological innovation, from knowledge and awareness, to intention and change of behaviour (Rogers, 2003). It focuses on information-communication and persuasion to the extent that problems of diffusion are related to these (Agarwal, 1983). DOI tends to put less emphasis on, and hence fails to properly address situational factors or material conditions that may constrain adoption of new technologies (Kowsari & Zerriffi, 2011 and Agarwal, 1983). The change agent and client may interact and exchange information about an innovation (Rogers, 2003). However, implicit in the approach is unequal and hierarchical relationships between the change agent and the client in which the former are seen as having superior knowledge and the latter as not knowledgeable about what is good for them (Agarwal, 1983). In addition, the level of interaction is limited to actors and leaves out other structural elements and process elements in the Technological Innovation Systems (see Chapter 1, Section 1.4.6.1). In its application in the ICS innovation adoption, based on a study conducted by Gupta and Saraf (2014), it demonstrated that the rate of adoption of ICS innovation can be positive if the technology is perceived by the potential end-users as having greater relative advantage, compatibility, trialability, observability and less complexity in usage, underscoring the significance of user involvement in the diffusion process. For an ICS to achieve these attributes, for example compatibility, the user has to be involved at the design stages (ibid.).
Social network theory	Social network theory focuses on the role of social relationships in transmitting information, channelling personal or media influence, and enabling attitudinal or behavioural change (Liu, Sidhu, Beacom & Valente, 2017, p.1). In its application in ICS programme analysis, based on two studies (Ramirez, Dwivedi, Ghilardia, & Bailis, 2014; Miller & Mobarak, 2013) it demonstrated how interaction among some members of a social system could influence spreading of information about ICS innovation and its benefits or perceived disadvantages. Hence, social networks can facilitate uptake of the ICS technology (Ramirez et al., 2014) and may negatively affect uptake (Miller & Mobarak, 2013). Social networks also assisted in identifying key groups in a social system that are influential in disseminating information on ICS technology (Ramirez et al., 2014; Miller & Mobarak, 2013). In relation to the focus of this study, the limitation is that the level of interaction analysis in the two studies focused on one structural element, *actors*, leaving out other elements under structural elements as well as process elements (see Chapter 1, Section 1.4.6.1). This limitation, however, emanates from the theory. It

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[23] This is not intended to be an exhaustive review of all theoretical frameworks that posit interaction; however, these are some of the commonly cited frameworks in literature on household energy and particularly in ICS innovation.

	is also not clear how uptake led to initial use or sustained use in the two studies reported. As such, it appears that the application of Social Network framework in the ICS adoption concentrates only on uptake and not use.
Strategic Niche Management (SNM)	A core assumption of the SNM approach is that sustainable innovation journeys can be facilitated by modulating technological niches, which are spaces that allow nurturing and experimentation with the co-evolution of technology, user practices, and regulatory structures (Schot & Geels, 2008, p. 537) usually in the early phases of technology development (Atteridge et al., 2013). This allows learning about the desirability of the technology, and enhancing further development and rate of application of the new technology (Kemp et al. in Rehman, Kar, Arora, Pal, Singh, Tiwari & Singh, 2012). In its application in ICS practice, based on the study conducted by Rehman et al. (2012), the analysis of experiments, using SNM led to the identification of various drivers that may enable a shift from traditional stoves to ICS, and revealed both enablers and barriers to ICS adoption. The experiments also facilitated interaction between the technology and end-users that led to dissemination of an ICS model taking into consideration some socio-technical needs of the local population. However, the limitation was that the experiments focused on technological solutions only, without engaging users in reflexive processes on their cooking habits. i.e. ignoring cultural aspects.
Dual adoption framework	The core idea of the framework is that in the technology development process interactions are bottom-up as well as top-down (Atteridge et al., 2013). The framework, proposed by Simon (2010), underscores how the mobilisation process spans planning, implementation, and post installation phases of development and proceeds through a cross-scale 'collaborative technology mobilization process' (Simon, 2010, p. 2022). He argued that technology installation should reinforce integrated commitments of funding agencies, intermediary institutions, and grassroots groups who enter the development process once innovation frameworks are implemented (ibid.). The interaction described in his analysis of the ICS programme in Western India does not completely emanate from deliberate collaborative efforts among actors on how best to achieve development. It appears to emanate from the need to pursue different development objectives for different groups. In addition, it originates from the collaborative nature of technology mobilisation itself (Simon, 2010).

Source: Jalasi, 2018

2.12.1 Socio-Technical Systems (STSs)

In Chapter 1 (see Section 1.4.6.1), I have discussed STSs, providing the description of structural and process/ functional elements and highlighting the focus of STS analysis. To summarise the discussion in Chapter 1, the STS approach is particularly concerned with interaction between structural elements and process/function elements and on the role and importance of both developers and users in influencing innovation and diffusion processes.

Within Technological Innovation Systems, Bergek et al. (2008) developed a scheme of analysis that guides analysists employing a systems approach in the analysis of technology innovations. The framework is primarily used to assess systems performance as well as identification of factors influencing performance to inform policy formulation and direction (ibid.). This is because it allows a systematic identification of policy problems; hence, its employment can guide policy makers in their decisions in policy goal setting, reformulation, and redirection of policy objectives (ibid.). The scheme of analysis has six steps as described in Box 2.2 below.

Box 2.2: Six-step scheme for analysis of technological innovations

1. Setting the starting point for the analysis, which involves defining the Technology Innovation System in focus.
2. Identification of the structural components of the Technological Innovation System.
3. Identification of processes/functions in the Technological Innovation System. This involves analysing the functions by first describing what is actually going on in the Technological Innovation System in terms of the processes. This provides a picture of an "achieved" functional pattern, which is a description of how each function is currently filled in the system (quotes in original text).
4. Assessing how well the functions are fulfilled and setting process goals in terms of a desired functional pattern.
5. Identifying mechanisms that either induce or block a development toward the desirable functional pattern.
6. Specifying key policy issues related to the inducements and blocking mechanisms.

Source: Jalasi, 2018

In the ICS technology diffusion STS approach has been used, for example, to understand the development of the clean cookstove sector in Ghana (Agbemabiese et al., 2012) and to examine the clean cooking sector in India (Atteridge et al., 2013). Employing the analytical framework in combination with other analytical techniques, Agbemabiese et al. (2012) found that the interplay between the different system functions create feedback loops that function as motors of innovation (inducement mechanism) which have proven powerfully sufficient to sustain diffusion of ICS beyond Ghana borders. They also identified a number of barriers that collectively indicate misalignments between underlying structures (technologies and institutions, and so on) and the technical requirements of system functions (ibid.). Hence, the study defined sustainability of innovations in energy access in terms of fulfilment of system functions by a broad group of actors, including governments and entrepreneurs (ibid., p. 46).

Similarly, Atteridge et al. (2013) used the framework to assess the health of various processes in the Indian clean cooking sector and identified a number of crucial systems processes that were weak and needed to be strengthened in order to support the development and diffusion processes in the Indian cooking sector. They identified priorities to achieve this and suggested a number of things that could be done by various actors to achieve the priorities (ibid.). One of the main suggestions was that "… the very people whose practices are supposed to change, and who are expected to purchase clean cooking products, need to be seen as key actors in shaping the sector, not just as passive recipients of new technologies" (ibid., p. 23).

The strength of STS, which I find relevant for the study, is the systems approach to analysis that foregrounds interaction between both structural and process elements and how the interaction influences the systems performance. This sets STS apart from the other analytical frameworks reviewed, yet there are similarities with CHAT. Through the third generation of CHAT, which involves a network of activity systems, CHAT takes a holistic approach and includes both structural and process elements in the analysis of human activity (see Chapter 3, Section 3.2.1.2). In addition, some structural elements within

STS are similar to CHAT as described in Chapter 1 (see section 1.4.6.1). However, when it comes to the interaction between structural elements, CHAT goes beyond to give attention to agentive factors through its focus on agents and their interaction with others (community) (see Chapter 3, Figure 3.2). Further, CHAT's emphasis is on the interactions between these elements and a "shared object" of human activity. As discussed in Chapter 3, the object precedes and motivates activity; it gives the subjects of the activity direction (Engeström, 1993; Leont'ev, as cited in Edwards, 2005a). Despite the fact that the object of activity is not synonymous with goal (see Chapter 3, Table 3.1), I would like to highlight that: Technological Innovation Systems as an analytical framework acknowledges that "actors do not necessarily share the same goal, and even if they do, they do not have to be working together consciously towards it" (Bergek et al., 2008, p. 408). This sets it apart from CHAT as actors in the activity system and interacting activity systems work on a shared object and overall outcome (see Chapter 3).

Overall, CHAT involves a formative interventionist approach (Sannino, 2011) and it accomplishes this agenda through formative intervention approaches such as Boundary Crossing Change Laboratories Workshops (BCCLW) (see Chapter 3, Section 3.7.5) and DWR/ Expansive Learning (see Section 3.5.2), which were developed within CHAT. Through application of these methodologies, the formative interventionist researcher evokes and supports reflexivity and transformative agency in research participants – the core of learning for sustainability and transformation of human activity (Dybal, Brown & Keen, 2007; Brall, Hees & Henning, 2007). Thus, I opted to use CHAT to stimulate reflexivity in research participants necessary to examine their activities in relation to their actions and routines as they interact with the ICS technology against the risky society they live in. In addition, transformative agency enables them to initiate and steer changes in the ICS practice (see Chapter 3, Section 3.3). See also Sections 3.2.1 and 3.2.1.4 where I explain why I worked with CHAT in this study.

Agarwal (1983) raised a pertinent question on how the interaction between the end user, designers and project implementers (in fact among actors involved in the diffusion process) could be brought about considering the differential power relations inherent in the groups which usually translates into hierarchical learning interactions. The employment of BCCLWs provides space for horizontal learning among actors (see Chapter 3, Section 3.2.1.2) and helps to address Agarwal's question (see Chapters 7 and 8).

2.13 Conclusion

This chapter has discussed global concerns leading to the introduction of ICS technology, the potential benefits of ICS in relation to these concerns and to the progress of the Sustainable Development Goals. I have discussed the progress made in the dissemination efforts of the technology globally since its

evolution, revealing problems with scaling up of programmes, uptake, and utilisation, with a particular concern on sustained utilisation. In relation to this, I have highlighted fuel-device stacking as one major concern in the adoption of the ICS technology. In addition, I have discussed how scholars have responded to the prevailing problems. This discussion led to a review of the different dissemination approaches adopted by practitioners in three main phases of the development of the technology: centralised delivery system, participatory approaches, and market-based approaches. Each phase reveals a dominant approach, yet examples of all the three approaches are used in each phase. This discussion reveals that the main reasons behind the shifts in approaches was intended to be a positive way to respond to problems highlighted. However, it also reveals the top-down approaches inherent in the centralised delivery system, and its persistent remnants in the participatory and market-based approaches. I have also discussed subsidies and financing models as mechanisms to aid the diffusion of the ICS, including social marketing strategies used to reach out to end-users.

The chapter has also reviewed analytical frameworks used in the analysis of ICS programmes within the context of the study. The chapter has highlighted potentials and strengths of the dissemination approaches and the analytical frameworks and their limitations in relation to uptake and initial utilisation, sustained utilisation and implications for the learning-centred approach taken in this study. It has ended with a discussion that reveals the gap in change-oriented learning approaches in the diffusion of ICS technology, and how I envisage closing the gap with a learning-centred approach, using CHAT. Hence, the chapter ends with a brief motivation for CHAT, which also acts as bridge to the next chapter.

In the next chapter, therefore, I discuss the theories and methodologies that I employed in the study to answer the research questions. Troncoso et al. (2011) provided a relevant introductory remark for the next chapter: ICS technology "constitutes a grassroots work, it requires keeping close to people's needs and problems and working with them to find joint solutions for the overall fuel use problem" (p. 7605).

CHAPTER 3: THEORETICAL AND METHODOLOGICAL FRAMEWORK

3.1 Introduction

This chapter has two main parts: the first part focuses on the theoretical framework and the second part on the methodological framework employed in the study.

In the first part of the chapter, I discuss Cultural Historical Activity Theory (CHAT) as the epistemological theory and Critical Realism (CR) as the ontological theory that I drew on for an in-depth understanding of the object of the study. The two theories, including the methodology associated with Developmental Work Research/ Expansive Learning, helped me to answer the research questions outlined in Chapter 1, Section 1.5.

The two theories, CHAT and CR focus on learning as emancipatory process and transformation of human practices by evoking agency and reflexivity of the actors involved. The chapter starts with a discussion of CHAT, drawing attention to third generation CHAT where interacting activity systems are viewed as units of analysis. The discussion then focuses on how I applied CHAT in the study using Developmental Work Research (DWR)/ Expansive Learning methodology. DWR is a methodology developed within CHAT (Daniels, 2008; Roth & Lee, 2007) for supporting and developing expansive learning in work places (Engeström, 2001). I then discuss CR, stratified ontology, and show how this applies to the study, with emphasis on theoretical concepts of reflexivity, structure and agency, CR and CHAT conceptualisations of learning as transformative practice, contradictions as sources for change and development and Zone of Proximal Development (ZPD). The chapter also discusses Dialectical Critical Realism, and how it deepens the notion of contradictions as conceptualised in CHAT.

The second part of the chapter discusses the methodological framework employed in the study showing how DWR and its associated formative intervention approach were useful for the study because of their potential for transformative praxis. It describes intensive qualitative case study design used, methods employed for data collection, and the two phases that the study employed. I also present the analytical framework adopted, which is consistent with the critical realist stance employed in the study. Finally, I discuss how the study ensured validity and navigated ethical issues.

3.2 Theoretical Framework

This section discusses the two theories, CHAT and CR that I drew on in the study. The discussion starts with CHAT, then CR as underlabouring CHAT. In this section, I also discuss how the study conceptualises learning, drawing from the two theories and other learning theories.

3.2.1 Cultural Historical Activity Theory

Cultural Historical Activity Theory derives from the philosophy of Kant, Hegel, and Marx (Nunez, 2014 and Engeström & Miettnen, 1999). The key idea drawn from Hegel-Marxist conceptualisation of activity is that when people are involved in an activity, they want to transform nature, society, or some other object, and in the process of transforming the objects, people become cognitively transformed under existing material conditions (Nunez, 2014, p. 64).

Lev Vygotsky initiated CHAT in the 1920s and early 1930s; Vygotsky's colleague Alexei Leont'ev (Engeström, 2001; Engeström, 2015) further developed CHAT. CHAT emphasises socio-cultural-historical factors in shaping human activity and it is built on contradictions, reflexivity, and agency (Daniels, 2008; Engeström, 2015). Reflexivity and agency are key in learning for transformation of human activity (see Sections 3.3 and 3.4.1) and contradictions are sources of innovations and changes in human activity (Nunez, 2014; Engeström, 2001) (see Section 3.4.3). CHAT therefore is a theory of learning and development (Roth & Lee, 2007): "CHAT seeks not only to explain but also, and more importantly to influence qualitative changes in human praxis" (p.210). Vygotsky's work and subsequent development thereof by Engeström and colleagues is based on the seminal findings in Vygotsky's work that 'learning leads development' (Vygotsky, 1978, p. 90) and that learning can shape the evolution of new human activity in open systems (Engeström, 2015).

The socio-cultural-historical perspective uses a principle of historicity (Engeström, 2001) (see Section 3.2.1.3) and guided an in-depth understanding of the object of this study from that perspective. I studied in depth, the development of the ICS activity in Malawi (see Chapter 1) and the historical development of the interacting activity systems and their objects (see Chapters 1 and 5, Section 5.2).

3.2.1.1 The Unit of Analysis in CHAT

The unit of analysis in CHAT is the activity system; it consists of a group of any size pursuing a specific goal in a purposeful way (Peal & Wilson, 2001, p.147). According to Cole and Engeström (1993) "activity systems are complex formations in which equilibrium is an exception and tensions, disturbances, and local innovations are the rule and the engine of change" (p.8). An activity system has seven elements as described in Table 3.1 below:

Table 3.1: Elements of an Activity System

Element	Description of Element
Subject	Individual or group whose viewpoint is adopted (Engeström, 1987, p. 78).
Object	"The 'raw material' or 'problem space' at which the activity is directed and which is moulded and transformed into outcomes with the help of physical, external and internal tools" (Engeström, 1993, p. 67).The object precedes and motivates activity. It is "what is being worked on", "what is being shaped or transformed by the tool" (Edwards, 2005a, p. 52).
Tools	Tools are external, material (for example, a cook stove, a textbook, or a computer), or internal, or symbolic (for example, language). They mediate the object of activity. Tools take part in the transformation of the object into an outcome, which could be desired or unexpected; they can enable or constrain activity (Engeström, 1987, p. 78).
Community	Participants of an activity system who share the same object (Engeström, 1987, p. 78).
Division of labour	Involves the division of tasks and roles among members of the community and the division of power and status (Engeström, 1987, p. 78).
Rules	They are explicit such as rules, and implicit such as norms that regulate actions and interactions within the system (Kuuti, 1996).
Outcome	Desired result of working on the object

Source**:** Engeström, 1987; Engeström, 1993; Kuuti, 1996; Peal & Wilson, 2001
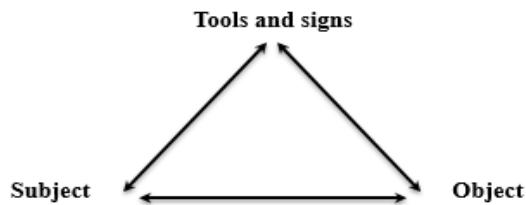
3.2.1.2 Three Generations of CHAT

Based on the work of Engeström (2001), activity theory has evolved through three generations. The first generation of CHAT developed by Vygotsky created the ideas of mediation commonly expressed as the triad of subject, object, and mediating artefact (p.134) (see Figure 3.1). The limitation of the first generation CHAT was that the unit of analysis remained individually focused; the second generation CHAT developed by Leont'ev overcame this limitation by explicating the crucial difference between an individual action and a collective activity (Engeström 2001, p.134). The third generation of CHAT developed by Engeström dealt with challenges that the second generation failed to address, which includes questions of diversity and dialogue between different traditions or perspectives (Engeström, 2001).

First generation CHAT: Central to Vygotsky's psychological research was the notion of the role of mediating artefacts, which are both technical and psychological (Engeström, 1987; Daniels, 2008). Vygotsky's focus was on the symbolic mediation of culture and on the relationship between human actions (object), human subjects (individuals), and cultural artefacts (tools) (Elhammoum, 2002; Engeström, 1987). Vygotsky's idea was to dispense with individual/ social dualism and create a Marxist psychology (Elhammoum, 2002; Edwards, 2005a) and it explained how the collective was incorporated into the individual through processes of mediation, which could be used to transform ways of thinking and acting to the benefit of the greater good (Edwards, 2005a, p. 52). Vygotsky distinguished between psychological tools, which could be used to direct the mind and behaviour, and technical tools that could be used to bring about change in other objects (Vygotsky, 1981 as cited in Daniels, 2008, p. 9). In his work on mediation, he echoed the role of human agency. He argued that humans master themselves

through external symbolic, cultural systems rather than being subjugated by and in them (Vygotsky, 1981 as cited in Daniels, 2008, p. 9). This means that the individual has the agentic power to transform his/her surrounding environment, for his/her self-development (Elhammoum, 2002, p. 96).

This study used second and third generation activity systems as the unit of analysis, however Vygotsky's ideas of human agency are central to this study (see Section 3.3), hence the foregoing discussion.
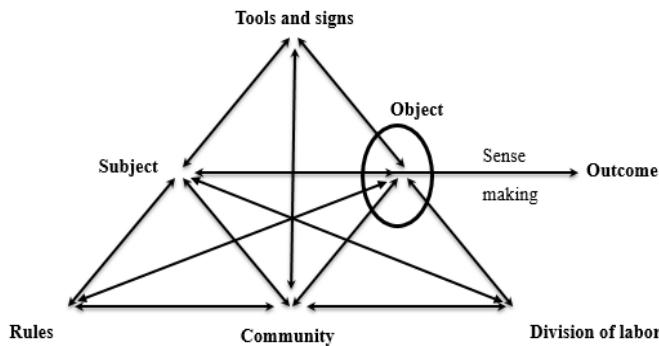
Figure 3.1: Vygotsky's model of mediated act
Source: Engeström, 2001, p. 134

Second generation CHAT: Within the second-generation activity system, the unit of analysis is defined as "object oriented, collective and culturally mediated human activity" (Kaptelinin, 2005, p.10). It focuses on the interrelations between the individual subject and his/her community (Engeström, 2001) by incorporating social or collective elements of community, rules, and division of labour (see Figure 3.2). It emphases the interaction between the elements in the activity system (Daniels, 2008, p. 122). Engeström (1993) also elaborated that the central relationship is between the subject and the object of the activity system, and it is mediated by rules for acceptable interactions; communities in turn help accomplish the activity system's purpose and outcomes through division of labour.

I used second-generation activity theory to identify interacting key activity systems involved in the ICS activity for a deeper understanding of the individual activity systems. The analysis of the individual activity systems helped in surfacing problematic situations within activity systems (see Chapter 6). Leont'ev (1978 as cited in Edwards, 2005a, p. 53) argued, "the main thing which distinguishes one activity from another, is the difference of their objects." However, in this study, I separated the three end-user activity systems, basing on the ways subjects interact with their objects (see Chapter 5, Section 5.2.1.6). Second generation guided me in understanding the levels of interaction and the kinds of situations in which subjects interact from the point of view of the subjects of each activity system, the existing learning interactions between subjects within and between activity systems, which helped me to answer research question 2 as discussed in Chapter 5. Thus, I used second generation to understand the network of activity systems involved in the ICS activity for each case study to illuminate part-whole relationships (Sayer, 2000).

Figure 3.2 below shows the structure of second-generation human activity system. The object is depicted in form of an oval, which indicates that object-oriented actions are always, explicitly, or implicitly characterised by uncertainty, surprise, interpretation, sense making, and potential for change (Engeström, 2001, p.134).

Figure 3.2: The structure of second-generation human activity system
Source: Engeström, 1987, p.78
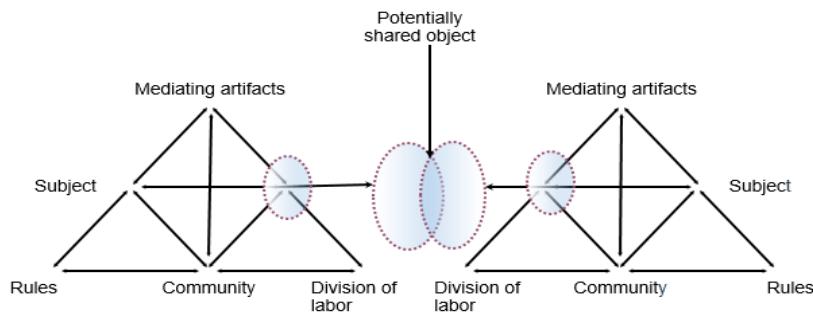
Third generation CHAT takes joint activity as the unit of analysis rather than individual activity (Daniels, 2008, p. 122). It happens when a number of activity systems of the kind described in Figure 3.2 above interact and share an object. Third generation supports the fact that all activity systems are part of a network of activity systems that in its totality constitutes human society (Marx, 1867/1976 as cited in Daniels, 2008, p. 123). Hence, I examined the interacting activity systems to potentially transform the networks of activities involved in the ICS activity. Since the ICS involves network of activities, I needed a holistic approach in dealing with the problems facing the ICS activity and I accomplished this using third generation CHAT that also enabled me to work with multiple perspectives, which are sources of learning.

In social learning, Wals, van der Hoeven and Blanken (2009) emphasised the need for learning from each other together for collective meaning-making and sense-making (p.11). This kind of learning is characterised by horizontal learning or boundary crossing. Boundary crossing is characterised by horizontal expertise where practitioners must move across boundaries to seek and give help, to find information and tools wherever they happen to be available (Engeström, Engeström & Karkkainen, 1995 as cited in Engeström & Sannino, 2010, p.12). Boundaries may be barriers to learning (Akkerman & Bakker, 2011); however in third generation CHAT, boundaries in the form of contradictions between two or more activity systems are seen as vital forces for change and development (Roth & Lee, 2007, p. 203) and "spaces" with the potential for learning (Akkerman & Bakker, 2011). I used third generation CHAT to bring the diversity of activity systems working with the ICS into an expansive learning process facilitated through Boundary Crossing Change Laboratory Workshops (BCCLWs) (see Section 3.7.5) coupled with the Expansive Learning Cycle (see Figure 3.4). This space provided opportunity for research participants

to transform the ICS activity through reconceptualising the object. Figure 3.3 shows how participants from different activity systems move in a new space, where opportunity arises to reflect on their individual objects to a collective meaningful object that satisfies each of the activity systems (Engeström, 2001; Akkerman & Bakker, 2011).

Star and Griesemer (1989) as cited in Akkerman & Bakker (2011) defined boundary objects as "objects that both inhabit several intersecting worlds and satisfy the informational requirements of each of them… their structure is common enough to more than one world to make them recognizable, a means of translation" (p. 2). Engeström (2015) pointed out that the boundary object can be expanded in multiple dimensions including: (a) the socio-spatial (who else should be included?) (b) The anticipatory-temporal dimension (what previous and forth coming steps should be considered?) (c) The moral-ideological (who is responsible and who decides?).

Figure 3.3: Two interacting activity systems as minimal model for the third generation of activity system
Source: Engeström, 2001, p. 136

3.2.1.3 Principles of Cultural Historical Activity Theory

Box 3.1 below presents principles of CHAT as summarised by Engeström (2001).

Box 3.1: Principles of Cultural Historical Activity Theory

a.	The main unit of analysis is a "collective, artifact-mediated and object oriented activity system seen in its network relations to other activity systems" (p. 136). "Goal-directed individual and group actions" are "subordinate units of analysis"; their interpretation should be based on the background of entire activity systems (p136).
b.	Activity systems are multi-voiced due to the members' different perspectives, which may become a source of trouble, but also a source of innovation.
c.	Activity systems' problems and potentials can only be understood against their history since they take shape and are transformed over lengthy periods. This principle is called historicity. Emphasis is on local history of the activity, its objects, theoretical ideas and tools that have shaped the activity.
d.	In CHAT, contradictions are seen as sources of change and development. They "are not the same as problems or conflicts", but "historically accumulating structural tensions within and between activity systems" (Engeström 2001, p. 137). In open systems, new elements adopted from the outside may generate contradictions.
e.	Activity systems are capable of expansive transformations, which happens when contradictions accumulate and aggravate (Nunez, 2014) and some individuals start to question and deviate from the established norms. In some cases, this situation leads to deliberate collective efforts to change the activity system. An expansive transformation occurs when the members perceive the object under a different light, which turns into a new object (Nunez, 2014, p. 43).

Source: Jalasi, 2018

3.2.1.4 Application of CHAT in the study

In the foregoing discussion, I have explained how and why I employed CHAT. This section serves to provide a summary of how and why I used CHAT in the study:

a. As a theory that focuses on learning and development, CHAT provided me with a different perspective in the study of diffusion of socio-technical innovations, specifically the ICS. Through CHAT, I was able to explore how different actors in the ICS practice learn the ICS technology and how this shapes the profile of uptake and utilisation of the ICS and how focusing on expansive learning processes can lead to changes and/or development of the ICS practice.

b. As a theory that focuses on socio-cultural-historical factors in shaping human activity, CHAT allowed me to study the ICS activity focusing on the socio-cultural-historical factors shaping the activity. Through historicity, CHAT allowed me to look at the socio-cultural-historical issues, including learning from the past and present, which informed the planning of expansive learning processes with participants.

c. The activity system as the unit of analysis allowed me to understand the ICS holistically. This is because I looked at each element in all interacting activity systems and the relationships between elements in interacting activity systems as having potential to constrain or enable uptake and utilisation. This helped me to have a deeper understanding of why the ICS practice is the way it is as described in Chapter 1 (see also Chapters 4, 5, and 6). The interacting activity systems I

worked with include policy, implementers, promoters, trainers, end-users, and production/construction groups. In Chapter 5, I have described how they interact as they work on the ICS activity in their various activity systems.

d. Cultural Historical Activity Theory provided me with the tool, BCCLW, that allowed me to facilitate horizontal learning among the different actors (Engeström, 2001).

e. Cultural Historical Activity Theory provided me with a methodology (DWR) to identify and analyse problems that ICS activity is facing, through focusing on contradictions within and between activity systems, and seeking ways of resolving them.

3.2.2 Critical Realism (CR)

CR developed at a time when Marxist thinking was strongly represented among social scientists in the 1970s. The main outlines of CR corresponded with some philosophical foundations of Marxism, especially in the approaches to social science. One of the main ideas connecting Marxist and CR philosophy is emancipatory politics (Benton & Craib, 2001, pp.135-136). According to Nunez (2014), Roy Bhaskar is the principal creator of CR. However, many authors have contributed to it; among others are Tony Lawson, Andrew Collier, and Margaret Archer. The main concern of CR philosophy is 'the natures of, and prospects for human emancipation; and it sets its agenda on under labouring for sciences (ibid., p. ix). Its main phases include Basic Critical Realism, Dialectical Critical Realism, and Philosophy of Meta-Reality. This study is concerned with stratified ontology and its implications for the object of the study and dialectics, which are characteristics of Basic Critical Realism and Dialectical Critical Realism, respectively.

3.2.2.1 Stratified Ontology

Drawing on the work of Sayer (2000), Benton and Craib (2001), Nunez, (2014) and Bhaskar (2016), CR argues for a multi-stratified world, which comprises the domains of the real, the actual, and the empirical. The main point that the stratification highlights is that causal laws, mechanisms and other objects of scientific knowledge cannot be reduced to domains of the actual or the empirical (Nunez, 2014, p. 45). That is the surface appearance of things may be potentially misleading as to their true character (Benton & Craib, 2001, p. 120). This allows for digging deeper beyond the actual and empirical (Sayer, 2000; Benton & Craib, 2001) to find the real. This makes CR a crucial ontological theory for underlabouring CHAT as employed in this study. More specifically, CR enabled me to understand more fully how structural factors shape transformative agency and potentials of various actors working with ICS. This is because the domain of the real contains mechanisms, events and experiences, and the mechanisms are the powers that exist and act independently of the flux of conditions that enable their identification (Nunez,

2014, p. 6). Nunez continued to elaborate that the three domains are overlapping, not independent of each other, but related to each other, and therefore events cannot occur without mechanisms, and experiences without events (ibid.). For example, women abandoning the stove after first use may be regarded as experiences, the crack of the stove on the upper door may be seen as one event causing the abandonment (the experiences), yet there are mechanisms giving rise to the crack. Therefore, CR as underlabourer for CHAT helped me to understand the causal mechanisms that are shaping the emergence of structural tensions and contradictions within and between the activity systems, which are a driving force for change and development. Mukute (2010) and Lindley (2014) have both shown in their studies that giving attention to underlying generative mechanisms provides for more robust explanations of the contradictions, which Engeström (2001) suggested must be analysed as manifestations of deep seated structural tensions. This has helped me to develop better explanations of why the ICS technology is the way it is, as described in Chapter 1.

CR has a commitment to changing unsatisfactory or oppressive realities, which is also in line with CHAT through the DWR, which focuses on stimulating agency and reflexivity in the participants to solve problems facing their lives in reflexive relation to structural constraints (Sayer, 2000; Benton & Craib, 2001; Daniels, 2008; Mukute, 2010).

Bhaskar (2016) argued that in terms of philosophical underlabouring, CR aspires to clear the ground through removing the rubbish that lies in the way of scientific knowledge (p. 2). In the case of this study, the identification of contradictions via critical realist causal mechanisms and focusing on transformation of ICS practice through resolving contradictions provides a different and robust scientific enquiry. It is a different way of approaching dissemination of socio-technical innovations, which have suffered from top-down approaches and evaluative studies that dwell on surfacing barriers (Chapters 1 and 2) without engaging with issues of structure and evoking actors' agency to transform the practice. This therefore is one contribution of the study to diffusion studies on socio-technical innovations via the critical realist philosophical lens and CHAT epistemological process.

Apart from underlabouring the epistemological theory, the study also benefitted from using some distinctive features of CR approach to philosophy, which provided me with the language to explain phenomena in the ICS practice. I drew on the following features from Bhaskar (2016, pp. 2-5):

(a)   CR aspires to produce a serious philosophy that we can act on, and one that is relevant to the pressing challenges we face and that may illuminate a way forward (telling us something new). This is what Bhaskar calls *seriousness,* which involves the unity of theory and practice, of not saying one thing and doing something completely different. Working with the concept

of seriousness has helped to explain the inconsistences found within the ICS practice (see Chapters 5 and 6) and inform the nature of solutions to the problematic situations (see Chapters 7 and 8).

(b)   The method of *immanent critique* specifies that criticism of an idea or a system should be internal by involving something intrinsic to what is being criticised. It typically identifies a theory /practice inconsistency that shows that the position being disputed involves a claim or analysis that would undermine itself. This helped me to identify internal contradictions, for example, around the ICS as a tool within end-user activity system. According to Mukute (2010), internal inconsistencies can be described as contradictions.

(c)   CR is committed to *explicating presuppositions,* which involves elucidating the normally unreflected presuppositions of our practices. This relates to *transcendental argument,* which asks what must be the case for some feature of our experience to be possible or what must the world be like for some social practice to be possible. This is also conceptualised as a *retroductive argument*, which asks what would, if it were real, bring about or explain a phenomenon. This is the process of identifying and analysing causal mechanisms that helped explain why uptake and utilisation of ICS is the way it is (see Chapters 4, 5 and 6).

(d)   The ultimate goal of CR philosophy is transformation of practice through better understanding and self-understanding of the agents involved. This means that CR like CHAT is committed to enhanced *reflexivity* as well as *transformed practice.* This study engaged with research participants to reflect on their actions and the problems they are facing in relation to the shared object of the ICS practice, model solutions for the problematic situations and come up with a model of a new ICS activity that potentially transforms the ICS practice.

(e)   Realist ontology makes it possible to understand how we could be or become many things, which currently we are not (Sayer, 2000, p. 12). This is what Bhaskar (2016) calls *dispositional realism,* which contends that possibilities, as well as actualities that are instances of them must be real. He also presupposes that agency is real, and that it can be transformed. This means that transformed transformative praxis is possible. According to Sayer (2000), the nature of the real objects present at a given time constrains and enables what can happen but does not pre-determine what will happen (p. 12). This is why the study focused on agentive processes stimulated via expansive learning in order to initiate and steer changes in a cook stove practice meeting resistance.

(f)   CR contends that the nature of all our knowledge across all domains is *fallible and provisional* and that it should be open to correction (Shipway, 2011; Benton & Craib, 2001), in the light

of further cognitive work, such as observations, experimental evidence, interpretations, theoretical reasoning and dialogue (Benton & Craib 2001, p. 121). Boundary BCCLWs as employed in this study, allowed for more dialogue, and considerations of interpretations from multiple voices engaged in the ICS practice from policy level to the woman in the kitchen. Additionally, this feature allowed me to study diffusion of social-technical innovation through a social-cultural-historical activity approach.

(g)   CR also offers *explanatory critique*, which enables one to explain false continuousness (Nunez, 2014, p. 33). According to Nunez, explanatory critique is necessary for learning science, social science and for the transformation of any society because it helps to explain false beliefs. Explaining false beliefs is important because the belief may not change since people will be unable to produce an explanation, and therefore the powerful social conditions that hold some beliefs cannot be changed (p. 33). Explanatory critique is necessary as it attempts to explain why people hold false beliefs (p. 34). This philosophical feature underpins the object of this study, which is geared towards the transformation of ICS practice. For example, if we cannot explain why there is a false belief that Chitetezo mbaula stove is fast when cooking, or that stove producers' involvement in marketing their stoves may reduce quality of production, then the possibility of changing it becomes slim.

3.2.2.2 Dialectical Critical Realism

Dialectic Critical Realism theorises the dialectics and the notion of contradictions. Drawing from Bhaskar (2016), the core meaning of **dialectics** deals with change, argument, and/ or freedom (p. 121). In Dialectic Critical Realism, dialectics involves **absenting of absences** (p. 121). **Absences** are constraints on well-being or ills (Bhaskar, 2016 and Bhaskar, 1998). In social-environmental contexts, the constraints and ills affect other living beings, the planet, its systems, and ourselves (Lotz-Sisitka, 2016). For example, the scarcity of firewood is a constraint on the well-being of women and children in most parts of Malawi and other developing countries in the world (see Chapter 1) which is related to the absence of more sustainable energy options in the cooking activity (see Chapters 1, 2 and 6). It is thus the object of this study to address such constraints through learning processes. Thus, the study contributes to the various environmental education processes that are trying to address, in different ways, the constraints or ills in society.

Dialectics originated from the writings of Hegel and Marx, and it denotes a simple learning process (Bhaskar, 2016). This learning process starts with leaving out a causally relevant factor in the description of something such as a theory or a phenomenon in the social world. Later on, as the work progresses, the omitted factor generates a problem that may take the form of **contradictions** or other inconsistencies.

If this omission is not remedied it results in a proliferation of contradictions or problems until the theory or social phenomena involved degenerates or changes from a state of order to a state of disorder, which Bhaskar calls 'entropic collapse' (ibid., p. 122). In order to bring back the order, there is need to remedy the absence causing the problem or the inconsistency generating the inconsistency (ibid.) with a deeper level of structure, or an aspect of totality that was not recognisable before (Nunez, 2014, p. 1). This resonates with the object of expansive learning – *learning what is not there* (Engeström, 2001) (my emphasis). This is where contradictions or inconsistencies are important in this learning process as they act as a signalling device to the community involved that something causally relevant has been left out (ibid., p. 122).

In Dialectical Critical Realism, the concept of absence is key because it helps one to understand and analyse change. This change involves "*absenting* of something that was there (undesired) and /or *presencing* of something that was not there" (Bhaskar, 2016, p. 115). "Presencing also means 'absenting the absence' of what was not there" (ibid., p. 115) (single quote in original text) (see Chapters 7 and 8).

Absence is also necessary for intentional agency, which always "presupposes a lack, want, conflict or need that calls for the action of remedying" (Bhaskar, 2016, p.115). The concept of absence allowed me to ask what was <u>not</u> there or what was missing in the ICS practice. This understanding provided me with insights in how to navigate my contribution as a formative interventionist researcher, together with the participants in the modelling of solutions to the contradictions identified. Formative interventionists have a substantive contribution to make and need to be very determined and systematic in offering the contribution (Engeström, 2015, p. xxxiii). Bhaskar (2016) asserted that "absence has a diagnostic value, particularly in social analyses as it allows looking at the social situation and asking what is *not* there that gives a researcher an invaluable insight into how the situation needs to change" (p. 119) (italics in original text).

Dialectic Critical Realism can deepen understanding of CHAT's philosophy and its notion of **contradictions** (Nunez, 2014). Hence, the use of CR in this study helped me in surfacing contradictions with a deeper understanding and enabled me to answer research question 3, which sought to identify contradictions that exist in the uptake and utilisation of ICS in the three case studies (see Chapter 6). In Dialectical Critical Realism, the notion of contradiction generally "denotes a constraint or a bind in a situation that may typically involve opposing parties" (Nunez, 2014, p. 71) and it deals with a well-known dilemma in everyday life (p. 72). One type of contradiction that Dialectical Critical Realism deals with is **dialectical contradiction**. For dialectical contradictions, "the connection between their elements (aspects or entities) forms a totality" (Bhaskar, 2008 in Nunez 2014, p. 74). The connection means that

the elements are 'distinct and inseparable', in time or by circumstance (emphasis in original). Nunez provided an example of a double bind between human beings and the continuous use of fossil fuels in the totality of the environment in which we live. She elaborated a contradiction as follows:

> … we think of a double-bind between human beings and the continuous burning of fossil fuels together in the totality of the environment in which we live. The essence of contradictions is that we cannot follow two paths; that is human beings cannot continue burning fossil fuels and expect to survive as if in an unchanged planet that does not involve human reality, actions, and their impact on their surroundings. (p. 74)

Dialectic Critical Realism enabled me to deal with real issues in the ICS practice since it argues for the "vital concept of contradictions to apply on real things in the world in human praxis" (Nunez, 2014, p. 74).

In summary, the two theories CHAT and CR are compatible as they have their roots in Marxism, and conceptualise learning as an emancipatory process. They both share interest in transformation of human practices by evoking agency and reflexivity in research participants to transform their activity. This I have found important in addressing the agenda of the study. The concept of dialectics is found in both theories. In CR, Bhaskarian dialectics involves a reflexive change-oriented learning process that leads to transformative praxis (Lotz-Sisitka, 2016), not unlike that of Activity Theory where dialectics is found in the logic of expansion, which entails a social and practical process involving collectives of people reconstructing their material practice (Engeström, 2015, p. 242). Additionally, both CR and CHAT share the notion of contradictions as a signalling device of something that has gone wrong in a system or a social practice and that their resolution can lead to transformed practice or activity (Nunez, 2014). The two theories also believe in the interplay between structure and agency, that structure has effects on humans; however, humans are endowed with individual, collective, and relational agency (Edwards, 2005b) to reproduce and transform the structure, as will be discussed below.

3.3 Structure and Agency

Drawing from the work of Bhaskar, (1998), Archer, (2003), Cruickshack (2003), Carter and New (2004) and Nunez (2014), we find ourselves in a structured context, which is not of our creation; however, the structured context has real effects on us. As humans, we are endowed with the agentive power to operate on society by either transforming or reproducing it. More importantly is the fact that the social structure always pre-exists individual agency and the role of individual agency is to reproduce or transform the structure (Nunez, 2014; Cruickshack, 2003). This concept of society has its origins from BCR in the works of Bhaskar (1979) which assert that:

> … people do not create society. For it always pre-exist them and is a necessary condition for their activity. Rather, society must be regarded as an ensemble of structures, and practices and

conventions, which individuals produce or transform, but which would not exist unless they did so. Society does not exist independently of human activity… But it is not the product of it … (Bhaskar, as cited in Nunez, 2014, p. 35).

Bhaskar (1998) elaborated that agents are always acting in a world of structural constraints and possibilities that they did not produce (p. xvi). These structures constrain or enable them in their activities. Archer (2003) expounded on this, and asserted that:

There are no constraints and enablements *per se,* that is as entities. These are potential *causal powers* of structural emergent properties such as distributions, roles, organisations, or institutions and of cultural emergent properties such as propositions, theories, or doctrines. (p. 5) (italics in original text)

However, the generative power to impede or facilitate projects from agents depends on whether they stand in a relationship in ways that they are able to obstruct or aid the achievement of the specific projects (Archer, 2003). From Activity theorists' point of view, "human beings are not at the mercy of extant institutional contexts, but they are endowed with the power to act (agency) which allows for critique and revision" (Roth & Lee, 2007, p. 210). This critique and revision has implications for transformation of activity, which is the focus of this study. I thus worked with the interplay between structure and agency to understand factors that influence the profile of uptake and utilisation (and /or failure to uptake and utilise) of ICS. I focused on the structural aspects via a critical realist analysis of causal mechanisms (see Chapter 6) and on stimulating and/or enhancing agency in research participants via agentive processes provided by expansive learning in BCCLWs (see Section 3.7.5; Chapters 7 and 8).

Cundill et al. (2014) contended that understanding human agency, which they define as the ability to act in the world, "requires focus on *what people think, value and do*. It also requires attention to *how* people do things, and *why* they choose to do certain things instead of others" (p. 7). This resonates with Billet, as cited in Eteläpelto, Vähäsantanen, Hökkä and Paloniemi (2013) who argued, "individuals practice agency in choosing problems they will engage in, and do so with different degrees of engagement, and this has implications for what is changed or learnt through their engagement" (p. 56). This conceptualisation necessitated me to investigate diffusion of socio-technical innovation using a socio-cultural theoretical lens as it provided me with the tools to understand *why* and *how* ICS actors choose to do certain things instead of others. For example, why implementers and policy makers choose to put end-users on the periphery of the ICS dissemination processes, yet they concentrate on formulation of production groups. I used this knowledge to seek ways of stimulating and/ or enhancing research participants' agency towards transformation of their activity.

Haapasaari, Engeström, & Kerosuo (2016) talked about agency that acts proactively or **transformative agency,** which is required in order to initiate and steer changes, which I found useful to work with in a

cook stove activity that is meeting some resistance. Transformative agency is defined as 'breaking away from the given frame of action and taking the initiative to transform it' (Virkkunen, as cited in Haapasaari et al., 2016, p. 233). Transformative agency differs from conventional notions of agency in that it stems from encounters with, and examination of disturbances, conflicts and contradictions in the collective activity (Haapasaari et al., 2016, p. 233). Transformative agency develops the participants' joint activity by explicating and envisioning new possibilities (ibid., p. 233). According to Sannino (2015b), transformative agency encompasses "a cluster of volition actions", which "involve questioning, and searching for new possibilities" needed to change the "circumstances" we live in and "shaping uncertain futures" (p. 1). The volitional actions emerge out of conflict of motives (see Chapters 6 and 8) and second stimulus (ibid.) (see section 3.5.1) In the description of the emergence of volitional actions with double stimulation, Vygotsky (1997 in Sannino, 2015a) provided a two-apparatus process. The apparatuses are relatively independent of each other, but correspond to two stages in the evolution of will: decision forming and decision implementation (ibid.) (see Chapter 8).

The concept of transformative agency is close to the concept of relational agency in that it goes beyond the individual as it seeks possibilities for collective change efforts (Haapasaari et al., 2016). However, they differ in that transformative agency is not limited to the relations of an individual expert as it underlines the crucial importance of expansive transitions from individual initiatives displayed through volitional actions and expands toward collective actions to accomplish systemic change through collaboration and collective agency (Sannino, 2015b; Haapasaari et al., 2016). Transformative agency also goes beyond situational here-and-now actions as it emerges and evolves over time, often through complex debates and stepwise crystallisations of a vision to be implemented and, in this sense, transformative agency resembles a notion of expansive agency (Haapasaari et al., 2014, p.2).

I worked with the concept of transformative agency to examine how participants took actions to transform the ICS activity via disturbances, tensions and contradictions identified (Hapasaari et al., 2014), through expansive learning processes. As Nunez (2014) argued, the most important question is "how to change or how to remove the constraint, so that the possibility for change arises from contradictions" (p. 73). Transformative agency is "a dynamic, long lasting process of learning and development, which evolves in interaction" (Hapasaari et al., 2014, p. 26). The evolution of the types of agentive actions/ (expressions) is in itself a learning process (ibid., p. 5). I used transformative agency expressions as both a tool for identifying and a framework for analysing (see Section 3.8.3.1) participants' agentive expressions and tracking expansive transformative learning processes from BCCLW deliberations (see Chapter 8). I focused on both individual and collective agency, by paying particular attention on how individual agency turned to collective agency through tracking speech turns (see Chapter 8). In order, to achieve this, I

drew from the following typology of transformative expressions defined by Engeström (2011) and with elaboration from Haapasaari et al. (2016) and Kachilonda (2015), as explained in Table 3.2 below:

Table 3.2: Types of Transformative Agency Expressions

Types of Transformative Agency Expressions
1. *Resisting* change, new suggestions or initiatives directed at the management, co-workers or interventionist
2. *Criticising* the current activity and most often highlighting the need for change in the activity
3. *Explicating* new possibilities or potentials in the activity; relating to past positive experiences as evidence of unacknowledged potentials or characterising the problematic object as a source of new possibilities and exciting challenges
4. *Envisioning* new patterns or models of the activity; which can range from preliminary suggestions to the presentation of comprehensive models for the future
5. *Committing* to concrete actions aimed at changing the activity, which is typically manifested in the use of commissive speech acts
6. *Taking consequential actions* to change the activity where participants of the interventions may perform consequential change actions within, between, and after laboratory sessions
7. *Confronting and navigating power relations* participants recognise, navigate power relations, and voice out the power they have which can be significant in mediating new ways of doing things in the activity. Taking consequential actions (outlined above) or being able to commit to actions is often dependent on the transformative agentive capacity to navigate or negotiate power relations (Kachilonda, 2015)

Source: Engeström, 2011; Haapasaari et al., 2016; Kachilonda, 2015

3.4 Conceptualising Learning

This section provides the theoretical foundation of learning that I drew upon in the study, in order to answer the research questions. As explained in Chapter 1, the goal of this study is to understand how actors are learning the ICS technology in order to expand the learning to facilitate sustained uptake and utilisation of the ICS technology. As such, it is important to elaborate how the study conceptualises learning. This study takes a change-oriented learning approach in the dissemination of the ICSs to address the challenges facing uptake and utilisation of the ICSs, as a different approach from approaches used globally. As discussed in Chapter 2, there is a gap in learning-oriented approaches to cook stove innovation dissemination that focuses on enhancing reflexivity and evoking and supporting transformative agency in research participants. It is in this view that the study contributes to diffusion of ICS socio-technical innovation using a change-oriented learning approach in order to address this gap. I have already discussed some conceptualisations of learning above that are consistent with the two theories employed, for example, boundary crossing. This section adds to those.

3.4.1 Reflexivity and Social Learning

In social learning literature, reflexivity is emphasised as key in learning for sustainability and transformation of human activities (Dyball et al., 2007; Wals & Van der Leij, 2007; Brall et al., 2007; Wals et al., 2009; Keen, Brown & Dyball, 2005). Brall et al. (2007) asserted, "the core element to optimise processes sustainably is reflection" (unpaged). Wals et al., (2009) argued for the need for a reflexive

society and reflexive individuals so that we are able to cope with risks in our society. They defined a reflexive society as:

> … a society that has the capacity to lay existing routines, norms and values on the table, but also has the ability to correct itself … it requires reflexive citizens who critically review and alter everyday systems that we live by and that we take for granted (p. 9)

According to Delanty (2005), reflexivity entails possessing a self-transformative capacity. It involves three aspects, the ability to look into oneself, to examine one's own practice and change it, and the ability to reflect on and talk about the social world (Abercrombie, Hill, & Turner as cited in Mukute, 2010). Hence, reflexivity includes as an aspect, a reflective way of thinking and acting which is crucial for participants to transform their activities.

Brall et al. (2007) asserted that reflexive learning also involves production of new knowledge and is the core of learning at all levels (unpaged). It helps to bridge the gap between our actions and ideas and the relationship between our knowledge, behaviour and values (Dyball et al., 2007). However, in order to reflect on our practices and ourselves "we need a catalyst that can help us see what would otherwise be invisible to us" (ibid., p.184). This study employed expansive learning to stimulate reflexivity in research participants in order to examine their activities in relation to their actions and routines against the risky society they live in (see Chapter 1) and in the process, identify contradictions and find ways of resolving them (see Chapters 6, 7 and 8). For the focus of this study, reflexivity is important because the ICS dissemination approaches used so far and some problem solving approaches employed, fall short (see Chapter 2). This situation requires ongoing reflexive searches for new solutions or ongoing development of human activity as proposed by Engeström (2015). I used reflective talk analysis (see Section 3.8.3.1) to understand how the expansive learning process stimulated reflexivity amongst the research participants and how this process lead to new understandings of their activities (see Chapters 7 and 8).

Social learning has been defined in various ways by different authors; however, its emphasis is on collective meaning and sense making (Wals et al., 2009). Wals et al. (2009) defined social learning as "a process in which people are stimulated to reflect upon implicit assumptions and frames of reference, in order to create room for perspectives and actions" (p. 11). This conceptualisation resonates with the focus of the study and third generation CHAT, in which multiple perspectives from interacting activities, are important for re-conceptualisation of a joint activity. The first phase of the study employed social learning to identify existing forms of social learning within the communities under study (see Chapter 5). This process has shown to be important in southern African in studies using CHAT, as it is often necessary to understand existing forms of relational learning and /or *learning interactions* (see Section 3.4.2) in community contexts in order to expand these (Mukute, 2010; Masara, 2011; Kachilonda, 2015).

This is also because existing learning interactions in such contexts are poorly documented in research literature.

3.4.2 Interactions as sources of learning

Almost all learning happens through interaction with living beings, or employing artifacts, such as tools, drawings, software (Glasser, 2007; Vygotsky, 1978), through interaction among groups with different belief systems and interpretive frames (Keohane & Nye; Wildawski; Glasbergen; Schön & Rein – all cited in Brown & Vergragt, 2008), through interaction with technology (Darby; Gertler & Wolfe, as cited in Brown & Vergragt, 2008); in interaction with the contexts of a problem situation (Schön, as cited in Loeber, van Mierlo, Grin & Leeuwis, 2007) and the environment (Cook & Brown, as cited in Blackmore, 2007).

The study sought to expand learning interactions among key activity systems working in the ICS practice through expansive learning processes. This is because of the existing tenuous interactions among them as discussed in Chapter 1. It is through expanding the interactions that I hoped to address the learning-knowledge-sharing gap among actors working in ICS. Schön as cited in Brown and Vergragt (2008) recommended facilitation of learning through enhancing interaction among actors.

Individuals engage in the process of learning through employing strategies that rely on some interaction with other people, artifacts, a problematic situation, and the environment. These strategies include among other things, observation, imitation, modelling, self-instruction, conservation and mentoring (Glasser, 2007). Through observation, for example, humans are able to form ideas of how new behaviours are performed, this coded information later on serves as a guide for action; however, emphasis is on continuous interaction, which has to take place between cognitive, behavioural, and environmental influences (Bandura, 1977 as cited in Glasser, 2007, p. 49).

Glasser (2007) made a distinction between passive and active social learning. This distinction reflects how interaction among collectives takes place. He contended that passive social learning does not require input or direct feedback from other people, for example, when people read a newspaper or search the internet (Glasser, 2007). However, the drawback is that information may be accepted uncritically and that it is limited in terms of generating substantively new social innovations (ibid.). Active social learning, on the other hand, is built on conscious interaction and communication between at least two people and it is inherently dialogical (ibid., p. 50). Three categories of active social learning reveal power dynamics among collectives and levels of participation in learning interaction, which include:

(a) Hierarchical, which is based on predetermined, inflexible relationships between established teachers and learners;

(b) Non-hierarchical, which is based on two-way learning, where each participant as an 'expert' in their own right shares their knowledge and experience; and

(c) Co-learning, which is based on non-hierarchical relationships, collaboration, trust, full participation and shared exploration. (Glasser, 2007, p. 50)

While hierarchical and non-hierarchical active social learning are used widely to expand the penetrations of knowledge, co-learning in addition to supporting the penetration of existing knowledge, supports the generation of new knowledge and novel strategies for addressing real-world problems (ibid., p.51). This study's interest was on co-learning in joint problem solving, necessary for the shared object.

Despite the fact that people and organisations are learning all the time (Engeström, 2001, p. 137) from interactions, it was useful to provide evidence of learning from interactions (see Chapter 5) happening among subject of activity systems in the three case studies in order to distinguish mere interactions and learning interactions. To define a learning interaction, the study drew from Blackmore (2007) and Engeström (2001) to provide evidence of the learning taking place. I used three questions: (a) Who are the subjects of learning? (b) What do they learn, what are the contents of the learning? (c) How do they learn, what strategies do they employ? I therefore defined a *learning interaction* in terms of the subject, the content, and the strategies used in a learning situation. On the other hand, *mere interactions* are those where subjects of activity systems interacted, but with no evidence of learning (as guided by the three questions) from data between or among the parties involved.

3.4.3 Contradictions as Sources of Learning

Contradictions play a significant role in activity theory. Contradictions have been described as sources of conflict and disturbance, but also sources of learning, change, and development (Engeström, 1987; Engeström, 2001; Edwards 2005b; Nunez, 2014). Change, learning, and development occurs in the activity systems under investigation when participants identify or recognise and resolve the contradictions (Edwards, 2005b; Murphy & Rodriguez-Manzanares, 2008; Nunez, 2014). As indicated earlier (see Section 3.2.1.3), the accumulation of contradictions in a system may lead to self-reflexive questioning and collaborative envisioning, that leads to learning (Engeström, 2001; Nunez, 2014).

The root of the idea that contradictions are a source driving change and development originates from Marxian analysis of the capitalist system and the Il'enkovian analysis of the dialectical system (Engeström, 2001; Nunez, 2014):

> The activity system is analogous to a capitalist mode of production, which is conceptualised to be in a contradictory state, in a type of perpetual crisis that renders its normal functioning invisible (Nunez, 2014, p. 70). In order to resolve its systemic contradictions, the system needs to be in a constant state of expansion and rejuvenation. (Engeström, 2001 in Nunez, 2014, p. 70)

Contradictions manifest as problems, ruptures, and breakdowns in the functioning of the activity system (Virkkunen & Kuutti, 2000 p. 302). With this understanding, it is important to approach contradictions from their manifestations, as argued by Engeström and Sannino (2011) (see Chapter 6, Section 6.2).

In CHAT, contradictions occur in situations involving forces pulling in opposite directions, or in other words, when there is a clash within and between elements of an activity system (Mukute, 2010; Mukute, 2016); in essence, this means that one cannot follow two paths (Nunez, 2014). Engeström (2015, p. 71) summarised contradictions into four levels, as described in Box 3.2 below. (See also Appendix 2 for a graphic representation of the levels of contradictions.)

Box 3.2: Four levels of contradictions within human activity

Level 1: Primary inner contradictions (double nature) are *within* each constituent component of the central activity system.
Level 2: Secondary contradictions arise between the elements of the central activity.
Level 3: Tertiary contradictions arise between the object/ motive of the dominant form of the central activity and the object /motive of culturally more advanced form of the central activity.
Level 4: Quaternary contradictions arise between the central activity and its neighbouring activities.

Source: Jalasi 2018

Contradictions may be related; primary contradictions may develop into secondary contradictions, and secondary contradictions may shape and influence tertiary and quaternary contradictions (Kachilonda, 2015; Turner & Turner, 2001).

The study focused on contradictions potentially to transform the ICS activity through engaging participants in reflexive processes and analysis of their activity during expansive learning processes. These learning processes led participants to find solutions to some contradictions. Participants were provoked to reflect on their current problematic situations; at the same time they defined where they want to be. This conceptualisation is found in Engeström's notion of the ZPD as discussed below. Nunez (2014) emphasised learning and change that comes out of contradictions (see Section 3.3), and how this process denotes rectifying an absence or an error in our existing knowledges. In this study, the expansive learning cycle enabled participants to model solutions out of the contradictions towards realising the activity's ZPD.

3.4.4 Zone of Proximal Development

The notion of ZPD is important in this study in relation to the overall goal to facilitate expansive transformation of the ICS activity. Vygotsky introduced the concept of ZPD in 1933. However, Engeström provided additional dimension to it. Vygotsky defined ZPD as:

> … the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (Vygotsky, 1978, p. 86)

In the discussion of the ZPD Vygotsky focused on assessment and instruction. He highlighted the relationship between an individual learner and a supportive other or others, even if that other was not physically present in the context in which learning was taking place (Daniels, 2008, p.19). Vygotsky's main concern was assessing how individual leaners make progress (ibid.) as well as how instruction should be planned. He contended that instruction becomes useful when it 'moves ahead of development', otherwise instruction would be completely unnecessary if it only 'utilized what had already matured in the developmental process', unless if it were itself a source of development (Vygotsky, 1987, p. 212).

Despite that Vygotsky's interest was on instruction and assessment, his conceptualisation of the ZPD strengthens the use of second and third generation activity system, and the interest in enhancing interaction among actors working in the ICS practice, as it shows how humans are capable of doing much more in joint activity. He asserted that human children "can go well beyond the limits of their capabilities" and that they "are capable of doing much more in collective activity …" (Vygotsky, 1978, p. 88). Vygotsky contended that instruction must be oriented towards the future (Engeström, 2015). This idea is embedded in the creative potential of creating a new form of activity through absenting constraints identified in the ICS practice. Holzman, as cited in Daniels (2008, p. 24) argued, "the social-cultural-historical process of creating ZPD is the revolutionary activity of people jointly (collectively, socially) transforming totalities."

In working with problems facing the ICS activity as a practice embedded in everyday lives of the woman cooking using the technology, individual actions play a significant role in the transition from individual agency to collective agency. Despite the fact that the prime unit of analysis in activity theory is the activity system, Engeström (2001) explained that goal-oriented individual actions are subordinate units of analysis that should be interpreted against the background of the entire activity system (p. 136). These individual actions are useful in the conceptualisation of ZPD in this study because, as discussed in Chapter 7, research participants aspire to move from the current situation of low energy efficient stove to high-energy efficient stove on one hand, and on the other hand, from low convenience to high convenience. This move entails that the two categories of the end-user activity systems (TSF user and the TSF and ICS users) need to transition to ICS users. In this regard, the everyday individual household's actions as they interact with the ICS play a major role in the attainment of the defined ZPD for a collective activity. Hence, I find Engeström's notion of ZPD relevant for the focus of this study, due to the nature of the object it is dealing with.

In the development of Expansive Learning, Engeström (1999a) described the cycle of expansive learning as the journey through the ZPD. In this regard, the notion of ZPD illustrates expansive transformation as learning (Nunez, 2014, p. 78). The ZPD is the collective journey towards potential resolution of double

bind problems in everyday practice (ibid.) It is a move towards something that is possible which is required in order to go beyond the present conflicting state (ibid., p. 79). Engeström (2015) described the ZPD as:

> The distance between the present everyday actions of the individuals and the historically new form of the societal activity that can be collectively generated as a solution to the double bind potentially embedded in the everyday actions. (p.138)

This means that the zone exists between the present, with the everyday individual actions, in their various interactions with the ICS, and the future in the collective creation of a new form of ICS activity. However, this requires resolution of the contradictions identified in the uptake and utilisation of the ICS (see Chapter 6). The expansive learning processes facilitated and sought to deal with these challenges (see Chapters 7 and 8). This frame of reference also means that Engeström's ZPD is open since the focus is in dealing with everyday constraints. The resolution of the present problems leads to new forms of challenges that require ongoing joint collaboration and resolution. As people resolve contradictions, more learning happens (Nunez, 2014; Edwards, 2005b).

The notion of *scaffolding* has been associated with Vygotsky's notion of the ZPD (Pea, 2004; Daniels, 2008; Nunez, 2014; Engeström 2015). However, what distinguishes Vygotsky's ZPD and scaffolding is that scaffolding is limited to the acquisition of discrete skills and actions, and not to the emergence of long-lasting molar activities; it is restricted to the acquisition of the given (Griffin & Cole, as cited in Engeström, 2015, p. 135). Collins, Brown, and Newman as cited in Pea (2004) remarked that the fundamental aspect of the scaffolding process is that the adult or knowledgeable other fades or reduces his participation, once the learner has grasped the targeted skill. He/she continues only to provide limited hints, refinements, and feedback to the learner, while the learner practises the skill to perfection (p. 431). Scaffolding therefore is described as "situations in which the learner gets assistance or support to perform a task beyond his or her own reach if pursued independently when "unassisted" (Wood, Bruner, & Ross, 1976, as cited in Pea, 2004, p. 430). In this study, scaffolding situations could be those that describe the relationship between a stove trainer and members of the stove production groups, or between knowledgeable pioneer stove implementers and the novice stove implementers as they work with the ICS technology. Thus, the concept of scaffolding helped me to describe how some actors were learning ICS innovation.

3.4.5 Informative and Transformative Learning

In trying to understand how actors were learning the ICS innovation and how the learning informed the profile of uptake and utilisation, I distinguished between informative and transformative kinds of learning. The two kinds have a role to play in both uptake and utilisation of ICS technology. Informative learning aims at increasing our stock of knowledge and range of skills and at extending already established cognitive structures (Kegan, 2009). No learning activity, discipline, or field is well nourished without

continuous opportunities to engage in informative learning (ibid., p.42). This kind of learning is aimed at 'what' we know rather than 'how' we know. This resonates with Rommetveit, as cited in Edwards (2005a) who described two approaches to learning, one concerned with 'knowledge about' and the other, a search for meaning (single quote in original text). Knowledge about is similar to informative learning while the concern for meaning relates to transformative learning. A similar explanation is between a decoding mind and an encoding mind. The decoding mind is the socio-cultural version of mind which is outward looking, resourceful and determined to interpret things and responding to the world, while an encoding mind is the information processing model of mind, which emphasises encoding, storing knowledge and recalling (Edwards, as cited in Edwards, 2005a, p.50). The "decoding mind also stores knowledge", it "seeks out patterns" and "uses environmental resources to support actions" (Edwards, 2005a, p. 50). Transformative learning is defined as "the process by which we transform problematic frames of reference, for example, mindsets, habits of mind and meaning perspectives, and sets of assumptions and expectations to make them more inclusive, discriminating open, reflective and emotionally able to change" (Mezirow, 2009, p. 92). Frames of reference are the structures of culture and language through which we construe meaning by attributing coherence and significance to our experiences (ibid.).

I used these approaches to learning to examine the approaches predominant in the learning that is taking place in the uptake and utilisation of ICS and to establish the gaps. This informed me on the type of approach to learning needed at the developmental stage of the ICS activity, in order to emphasise those approaches during modelling of solutions. According to Kegan (2009), both informative and transformative kinds of learning are expansive and valuable; in given contexts, a heavier weighting of one or the other may be called for (ibid, p. 42). While expansion occurs within a pre-existing frame for informative learning, for transformative learning, expansion occurs through reconstruction of the very frame. This conceptualisation requires understanding completely the form that is undergoing transformation (ibid.), for example, a current form of activity.

Informative learning, for example, is valuable for early diffusions stages of the innovation, such as awareness stages for uptake, when actors require understanding of the new technology. This kind of knowledge is important as it helps to build one's confidence in the particular activity, for example, an end-user will be confident to utilise the stove if she was sensitised on handling. In later diffusion stages, transformative learning may be more necessary, especially in the situation where a technology is meeting some resistance as the situation described in Chapter 1. This may necessitate facilitation of expansive learning processes, to arouse critical reflection on the problematic situations, in order to resolve them.

3.5 Methodological Framework

This section discusses the methodology employed in the study pursuant to the purpose of the study, which is transformation of the ICS activity. The approaches and methods employed are in line the transformative agenda of CHAT and CR, consistent with the goal of the study (see Chapter 1, Section 1.5). The selection of approaches and methods also largely conforms to the epistemological theory employed (CHAT). CHAT is an interventionist approach (Sannino, 2011) and it accomplishes this agenda through formative interventions coupled with intervention toolkits such as BCCLWs, and DWR/ Expansive Learning that support the BCCLW. BCCLW involve two or more activity systems as opposed to Change Laboratories that are conducted in an activity system (Engeström & Sannino, 2010). I employed these approaches and methods in this study to answer the research questions as indicated in Chapter 1 and potentially realise the purpose of the study. In order to answer the research questions, I also needed an in-depth understanding of the socio-cultural-historical factors shaping profile of uptake and utilisation and learning interactions among ICS actors. Hence, I employed intensive qualitative case study design in order to have an in depth understanding of the factors, construct meaning in context and have strong causal explanation (Sayer, 2000).

The section discusses formative interventions and DWR/ Expansive learning as the two approaches with transformative potential. It discusses the intensive qualitative case study design, methods used to collect and generate data and the research process – from gaining access in the study sites to processing and analysing data. Further, I discuss how I ensured validity of data, how I navigated ethical issues, through the research journey.

3.5.1 Formative Intervention Approach

The methodology of formative intervention was developed to support practitioners in work places, communities and educational institutions to cope with challenging changes and work out contradictions in their activities (Sannino, Engeström & Lemos, 2016; Engeström & Sannino, 2011). Formative interventions need to respond and build on the energy of contradictions in the activity system under investigation; in this case, contradictions become the driving source of change and development (Engeström, 2011). Drawing from Engeström (2011) and Sannino et al. (2016), key features of formative intervention include:

(a) Collective design where participants of the activity system under investigation face a problematic and contradictory object within their activity which they are expected to collectively analyse and expand by constructing a novel concept, the contents of which are not known ahead of time to

the interventionist researcher (Sannino et al., 2016; Engeström, 2011). The collective design is seen as the core of an expansive learning process (Sannino et al., 2016).

(b) The core mechanism of formative intervention is double stimulation. It occurs when participants are presented with two sets of stimuli containing video-taped disturbances, interview excerpts or other artifacts that reveal problems and tensions in the activity under investigation. According to (Vygotsky, 1978, p. 74), the main idea of double-stimulation was not to limit the subject to simple stimuli and expect a direct response, rather provide a second stimulus, which aids the subject to accomplish a task using auxiliary means. "In double stimulation, the first stimulus is the problematic situation, which triggers a paralysing conflict of motives" (Sannino et al., 2016, p. 604). Participants try to cope with the situation by employing artifacts, second stimulus that help them gain control and transform the problematic situation (ibid.). This implies that participants can potentially gain agency and take charge of the process (Engeström, 2011). At the heart of understanding the methodology of double-stimulation, is intentionality and agency. In his description of artifact-mediated intentional action, Vygotsky, as cited in Engeström (2011) asserted

> … man subjects to himself the power of things over behaviour, makes them serve his own purpose, and controls that power as he wants. He changes the environment with the external activity and in this way affects his own behaviour, subjecting it to his own authority. (p. 605) *[Sic]*

I employed double stimulation during BCCLWs and expansive learning processes (see Sections 3.7.5 and 3.5.2) to help participants analyse their problematic situations, establish their intentionality and agency, and resolve contradictions identified towards the transformation of the ICS practice.

(c) Formative intervention research aims at generating new concepts that maybe used in other settings as frames for the design of locally appropriate new solutions. A key outcome of formative interventions is agency among participants (Engeström, 2011, p. 606). This guided my analysis of the BCCLW to track the emergence of transformative agency arising amongst participants (see Section 3.8.3.1) as evidence of a learning process by participants (see Chapters 7 and 8).

(d) "The role of the interventionist researcher is to provoke and sustain an expansive transformation process that is led and owned by the practitioners" (Engeström 2011, p. 606). However, Engeström (2015) elaborated that formative interventionists may introduce their own ideas and aims and that they have a substantive contribution to make and must be very determined and systematic in offering the contribution (p. xxxiii). These call for researcher reflexivity (see Section 3.10.4). As a formative interventionist research, the study had two main phases (see Table 3.5).

3.5.2 Developmental Work Research and/ Expansive Learning

As indicated earlier, formative interventions are supported by the Expansive Learning cycle often referred to as Developmental Work Research (DWR) (Daniels, 2008). This section is dedicated to discussing the approaches that I used in the study with the intention to expand learning among the key activity systems (see Chapter 1) in two case studies through BCCLWs.

DWR is a methodology developed within CHAT for supporting and developing expansive learning in work places (Engeström, 2001). This methodology has shown its potential for transformative praxis in southern African environmental education research (Mukute, 2010; Masara, 2011; Lindley, 2014; Kachilonda, 2015; Baloi, 2016). This study used DWR methodology as it focuses on change-oriented learning. I found the approach useful to work with participants to analyse and work out contractions in their activity systems because the approach enabled me to exploit the crucial point of working with contradictions as a source of change and development which sets this study unique in the dissemination of ICS in Malawi, the region and internationally. The Expansive Learning cycle (see Figure 3.4) allowed participants in BCCLWs to bring about change through modeling solutions out of the contradictions identified in their activity system. In successful expansive learning processes, this would lead to a new form of activity (Sannino et al., 2016) as the process involves working out and resolving contradictions in the activity to be transformed (Engeström, 2015, p. xxiii).

The theory of expansive learning "puts the primacy on communities as learners, on transformation and creation of culture, on horizontal movement and hybridization, and on the formation of theoretical concepts" (Engeström and Sannino 2010, p. 2). This horizontal aspect is conceptualised as boundary crossing (see Section 3.2.1.2) and it is a powerful lens for analyses of sideways interactions between different actors, as well as activity systems. However, Engeström (2015) emphasised that the vertical or hierarchical aspect of learning and development should not be overlooked (p. xxv) and acknowledged that both horizontal and vertical learning are possible in expansive learning. In order to capture the horizontal aspect of learning during expansive learning I engaged boundary interaction analysis (see Section 3.8.3.1). Figure 3.4 below shows the Expansive Learning cycle with its seven epistemic actions. Table 3.3 below describes the actions.
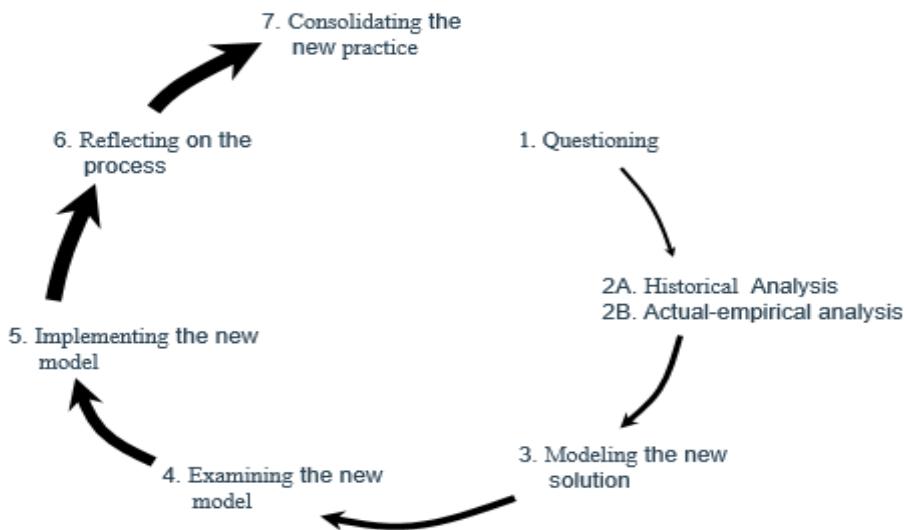
Figure 3.4: Sequence of epistemic actions in the Expansive Learning Cycle
Source: Engeström, 1999b, p. 384

Table 3.3: Epistemic actions in the Expansive Learning cycle

Epistemic action	Description
1. Questioning:	Criticising or rejecting some aspect of the accepted practice and existing wisdom.
2. Analysing:	Evokes "why?" questions and explanatory principles, which seeks out causes or explanatory mechanisms. It involves two types of analyses (a) "historical-genetic analysis", which "seeks to explain the situation by tracing its origins and evolution" (b) actual-empirical analysis, which "seeks to explain the situation by constructing a picture of its inner systemic relations".
3. Modeling:	Involves constructing an explicit, simplified model of the new idea that explains and offers a solution to the problematic situation.
4. Examining the model:	Involves running, operating, and experimenting with the new model in order to fully grasp its dynamics, potentials, and limitations.
5. Implementing the model:	Involves working with the new model in real life situations and monitoring its impacts.
6. Reflection:	Involves using monitoring data to evaluate the model for refinement.
7. Consolidation:	Involves implementing the refined model or the outcomes into a new stable form of practice or part of practice.

Source: Engeström & Sannino, 2010, p. 7; Engeström, 1999b, p. 384

The theory of expansive learning is based on the principle of ascending from abstract to concrete, which has its roots in dialectics (Sannino et al., 2016; Engeström, 2015). This involves "production of an idea or concept, initially in the form of an abstract simple explanatory relationship, which is "a germ cell"" (Engeström, 2015, p. xx) (quote in original text). "The initial abstraction is systematically enriched and transformed into a concrete system of multiple constantly developing manifestations" (ibid.). The germ cell is expansive because it opens up rich and diverse possibilities of explanation, practical application, and creative solutions (Engeström, Nummijoki & Sannino as cited in Sannino et al., 2016). The germ cell stimulates further development and interaction with other processes (Blunden, 2015).

The process of ascending from abstract to concrete involves "practical experimentation with a problematic situation" (Sannino et al., 2016, p. 605). The application of expansive learning cycle in this study was useful because the specific epistemic actions in Figure 3.4 above allowed occurrence of the process of ascending from abstract to concrete in and with the participants. By generating novel implementations and extensions of the germ cell (Greeno, in Sannino et al., 2016), research participants ascended from abstract to concrete. For instance, an idea originating from a participant trying to deal with a constraint in the use of the ICS during BCCLWs was elaborated through thought experiments and concretised during practical experimentation with the problematic situation. Practical experimentation fostered generative reasoning and generated germ cell ideas such as a set of future oriented initiatives evidenced from talk and new way of doing things such as cooking *nsima* with "*support*" on the ICS (see Chapter 8, Photo 8.3).

In the development of the theory of Expansive learning, Engeström drew from Bateson's (1972) conceptualisation of levels of learning (Engeström & Sannino, 2010; Daniels, 2008; Engeström, 1987). While acknowledging the importance of level I learning (Engeström 1987) and contending that all the three levels can occur in expansive learning (Daniels, 2008), he drew on level III (see Table 3.3). Level III is similar to expansive learning (Engeström & Sannino, 2010; Engeström, 1987) in that it involves reformulation of problems and the creation of new tools that can be used in engaging with the problems. Engeström (1987) elaborated that the ongoing production of new problem-solving tools enables subjects to transform the entire activity system and potentially create, or transform and expand, the objects of the activity (pp. 158-9). The three levels of learning are summarised in Table 3.4 below.

Table 3.4: Learning Levels

	Description	Example
Level I	Conditioning through the acquisition of responses deemed correct within a given context	Learning the correct answers and the behaviours in a classroom. An example from this study would be a woman learning the correct measurements and dimensions of a stove when producing stoves
Level II	Acquisition of the deep-seated rules and patterns of behaviour	Learning the hidden curriculum of what it means to be a student. An example from this study would be learning weather patterns or seasonal changes that affect the production of quality stoves.
Level III	Radical questioning of the sense and meaning of the context and the construction of a wider alternative context	Learning leading to change in organisational practice. An example from this study would be learning the causes of a crack on the upper door of a stove that would lead into creation of new tools to solve the problem and potentially transform and expand the object of activity.

Source: Adapted from Daniels (2008, p. 126)

The situation described in Chapters 1 and 2 (see also Chapters 4, 5, and 6) requires joint radical questioning of the context to deal with the challenges facing the ICS activity and find solutions to the contradictions within and between activity systems. This joint radical questioning occurred during BCCLWs and the outcome of the learning processes are presented in Chapters 7 and 8.

3.5.3 Qualitative Research Design

According to Henning (2004, p.1), qualitative studies usually aim for depth and seek to find out *what* happens and also *how* it happens and more importantly *why* it happens the way it does in particular settings. Qualitative research provides clear and detailed account of actions and representations of actions as much as possible in order to gain better understanding of the world and use it to bring about a measure of social change (ibid.). This resonated with the goals of this study as indicated in Chapter 1, Section 1.5). I sought to have an in depth understanding of: (a) **what** happens within and between the activity systems in terms of existing social learning interactions, limitations, tensions, and contradictions inherent in the ICS practice; (b) **how** this learning is happening, and more importantly, (c) **why** the profile of uptake and utilisation of ICS is problematic, with the aim of establishing how it can be improved.

As Flyvbjerg (2006) argued, the choice of method should clearly depend on the problem under investigation and its circumstances (p.226), I found qualitative research suitable to address the research problem as indicated in Chapter 1. Qualitative research provided me a means to access unquantifiable facts (Berg, 1998) on uptake and utilization. However, quantifiable facts were also important for the study. I used quantifiable facts (see Chapter 4, Sections 4.2.1.1, 4.2.1.2, 4.2.2.1, 4.2.2.2, 4.2.3.1, and 4.2.3.2), to describe the profile of uptake and utilisation of ICSs as a necessary step in establishing the extent of the problem, and the starting point in addressing the research problem.

According to Maxwell (2009), qualitative research helps in addressing numerous practical goals. It helps when your goal is to conduct formative studies that are intended to help improve existing practice rather than simply to determine the outcomes of the programme or practice being studied (p. 222). It also helps when your goal is to engage in collaborative, action, or "empowerment" research with practitioners or research participants (p. 222) (quote in original text). This resonates with the formative intervention intention and focus of this study as described above which required to work with participants to transform the ICS practice through BCCLWs that require more collaborative efforts research participants. Evoking transformative agency in research participants is a form of empowerment (see Chapter 8) towards the emancipatory agenda consonant with CR and CHAT (see Sections 3.1, 3.2.2 and 3.2.2.2).

This study is also interested in how research participants make sense of the object of their activity in order to work with them in reconceptualising the shared object. Qualitative research helped me to understand how research participants arrange themselves and their settings and how they make sense and meaning of their surrounding through cultural norms, symbols and tools, social structures, and social roles (Berg, 1998, p. 7) in relation to the ICS socio-technical innovation uptake and utilisation.

3.5.4 Intensive Research

This study used an intensive approach within a qualitative research design. This is because an intensive approach is concerned with what makes things happen in specific cases. The focus of this study was to understand constraints and contradictions in the everyday practice of communities as they interact with the ICS technology. With a critical realist stance adopted in this study, I needed a research approach that could assist me to seek and explain the causal mechanisms shaping contradictions within and between ICS activity systems. Intensive research is strong on causal explanation and interpreting meaning in context (Sayer, 2000, p. 21). According to Sayer (2000), the objects of social scientists' study are concrete because they are the products of multiple components and forces. Due to this, it is difficult to isolate out the components. Sayer (2000) contended that "social systems are open, complex, and messy" (p. 19), and therefore this requires abstraction and careful conceptualisation, but more importantly, attention to how we abstract. This can help us to avoid running the risk of misattributing causal responsibility. Intensive approaches guide the researcher on how to abstract and interpret meaning in context. Sayer elaborated:

> The intensive researchers would start at a particular point […] follow up the connections of the organ or part in question to other parts of the body, building up pictures of the body's structure and systems […]. Intensive research seeks out substantial relations of connection and situates practices within wider contexts, thereby illuminating part-whole relationships. (p.22)

This reverberates with how I worked with the second and third generation CHAT. I examined an element of an activity system, the interaction between elements of an activity system and interaction between elements of different activity systems. This helped me develop an in-depth understanding of the ICS practice, the structures, people's agency, and the whole system to address the research questions.

3.5.5 Multiple Embedded Case Study Design

Yin (2012, p. 6) defined a case as a bounded entity; the entity can be a person, an event, or other social phenomenon. The case serves as the main unit of analysis (ibid.). When different sub-units are involved in each of the different cases, they are called multiple embedded case studies (Yin, 2012; Yin, 2009). Multiple embedded case studies are also referred to as nested cases (Yin, 2012; Lotz-Sisitka & Raven, 2004). When that is the case, one has multiple units of analysis.

This study employed multiple embedded case design because the data resulting from its application can provide greater confidence in research findings (Yin, 2012). I worked with three case studies. Within each case study, there were a minimum of five activity systems, which served as individual units of analysis within the second generation of CHAT (see Section 3.2.1.2.). The activity systems in each case study interact through a partially shared object and form a unit of analysis in line with third generation of CHAT (see Section 3.2.1.2). Figure 3.5 below shows the multiple embedded case studies employed in the study,

with an oval in between them depicting the partially shared object. The end-user activity system has three sub-units, which include ICS user activity system, TSF user activity system and TSF and ICS user activity system in all the three case studies. These formed units of analysis individually, and holistically as one unit of analysis (end-user activity system). For further explanation on the end-user activity system, (see Chapter 4, Section 4.2.1.1 and 4.2.2.1, and Chapter 5, Section 5.2.1.6).

3.5.5.1 Why Case Study Approach?

I found case study approach a suitable approach to address the problems as discussed in Chapter 1 and to assist me in answering the research questions that needed in-depth understanding of the context in which research participants operate. The emancipatory agenda of the study, in line with the Critical Realist intensive approach and CHAT's interest in seeking relations of connections to understand social practices and illuminate part-whole relationships, led me to the choice of case study approach.

Sturman (in Cohen, Manion, & Morrison, 2011) argued:

> a distinguishing feature of case studies is that human systems have a wholeness or integrity to them rather than being a loose connection of traits, necessitating in depth investigation. Further, contexts are unique and dynamic, hence case studies investigate and report real-life, complex dynamic, and unfolding interactions of events, human relationships and other factors in a unique instance. (p. 289)

Case studies are a 'step to action'; they begin in a world of action and contribute to it (Cohen, Manion and Morrison, 2011). This study was not only interested in surfacing contradictions in the ICS practice; it used them for changing the practice. Insights gained from case studies may be put to use in bringing about change at an individual, institution, or policy level (Cohen et al., 2011). Insights obtained from one case may be used to provide insights to similar situations and cases, which can assist in interpreting other similar cases (Nisbet & Watt, in Cohen et al., 2011). The ICS practice is implemented in many places around Malawi; some are new practices, and most places use Chitetezo Mbaula, while there is also some use of the fixed stove. The insights gained from the three case studies can make valuable contributions to these cases.

Another key element that led me to choose the case study approach is that they "can replace quantity with quality and intensity, separating the *significant few* from the *insignificant many* instances of behaviours" (Cohen et al., 2011, p. 294) (italics in original). Cohen et al. elaborated that significance rather that frequency is the hallmark of case studies, which offers the researcher an insight into the real dynamics of situations and people (ibid., p. 294). Within the case studies under this study, some behaviours were revealed from single individuals. For example, in Chapita Village case study, only *one* household among the households that participated in the study was using the ICS exclusively, and another *one* constructed a fixed stove unique in the case study area (see Chapter 4, Photo 4.2). In Waziloya Makwakwa, only *one* household was using ICS and TSF (see Chapter 4, Section 4.2.2.1). The

case study approach, with the support of CHAT and Critical Realism, assisted me to penetrate these *single occurrences qualitatively.*

Case study research allows events and situations to speak for themselves (Cohen et al., 2011; Creswell, 2003), rather than to be largely interpreted, evaluated or judged by the researcher (Cohen et al., 2011, p. 290). This allows catching the close-up reality (Geertz, 1973 in Cohen et al., 2011) through thick descriptions of the participants' lived experiences of, thoughts about, and feelings for a situation (Cohen et al., 2011). The use of thick descriptions contributes to validity of research findings (Cohen et al., 2011; Creswell, 2003; Teddlie & Tashakkori, 2009). In reporting the findings of this study, I have used thick descriptions in this way.

Case studies are grouped in three main types, intrinsic, instrumental, and collective. According to Stake (1994) and Berg (1998), intrinsic case studies are undertaken when a researcher wants to understand the particular case better and <u>not</u> to represent other cases, or to illustrate some particular trait or problem (Berg, 1998).The case may be interesting because it is unique or ordinary (Stake, 1994).
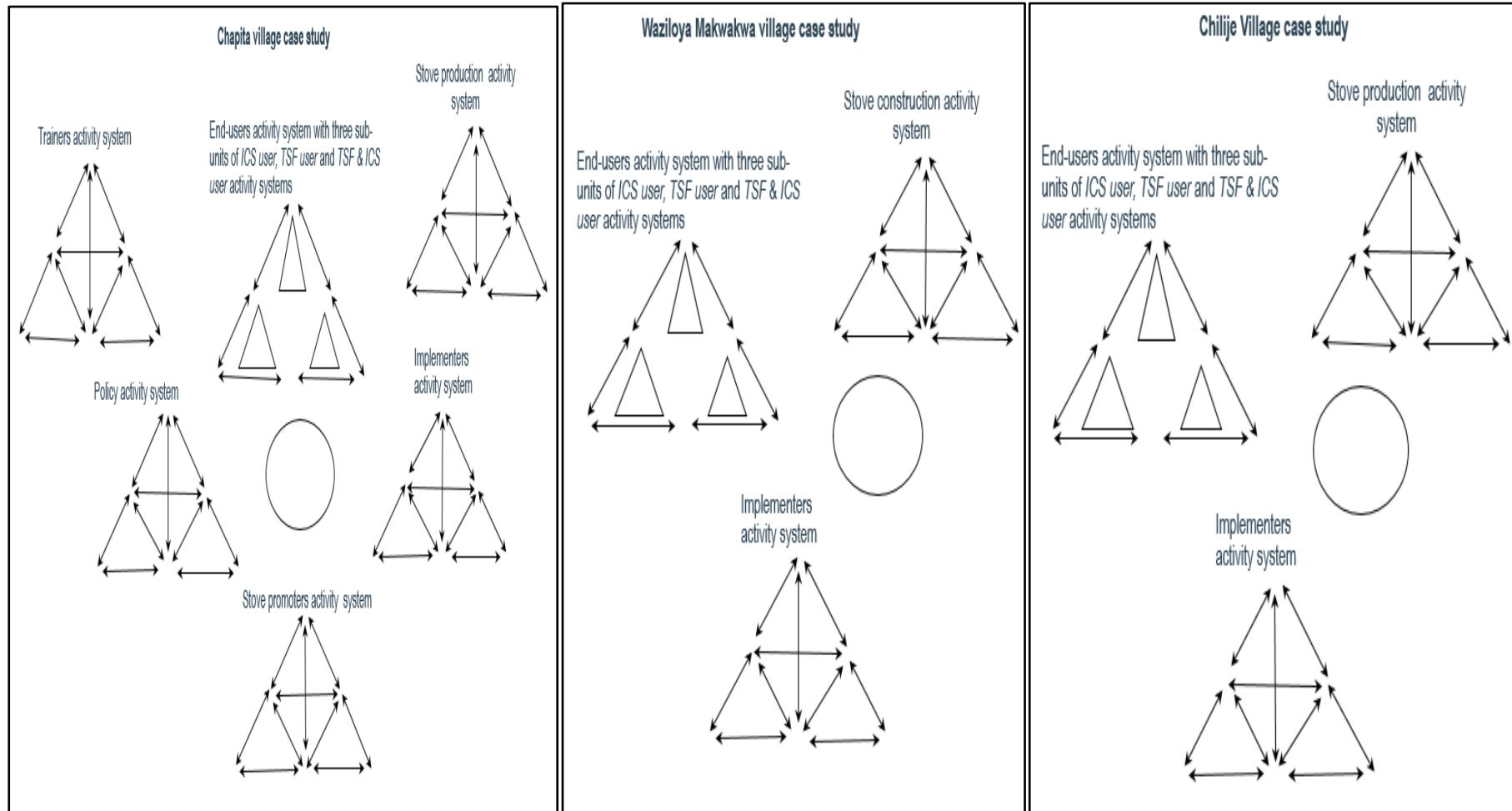
Figure 3.5: Multiple embedded case study design employed in the study

Source: Jalasi, 2018

Instrumental case studies are done to provide insight to some issue or to refine some theoretical explanation (Stake, as cited in Berg, 1998). The intention for undertaking an intrinsic case study is to understand better some external theoretical question or problem (Berg, 1998, p. 216). Collective case studies involve the extensive study of several instrumental cases (ibid.). However, it is difficult to demarcate between intrinsic and instrumental case studies because researchers have multiple interests (Stake, 1994). This resonates with the case studies undertaken in this study: they were undertaken to get an in-depth understanding of the ICS practice in the country, as well as to gain insight into *how end-users navigate the problems of firewood scarcity, when the ICS is rarely used or abandoned*. Barnes et al. (1993), in a review of stove programmes globally, contended that scarcity and costliness of fuels are effective inducements for using improved cook stoves. This theoretical backdrop underpinned the employment of instrumental case studies. The reason for undertaking several of the instrumental case studies was to have a wider contextual basis and understanding for articulating how participants are learning the ICS innovation in the country. The wider contextual understanding would contribute to the generation of an innovative extension and communicative methodology that can link the socio-technical innovation intention and socio-technical innovation uptake and utilisation which can inform the dissemination of ICS innovation in the country, the region and internationally.

Generalisability has been one controversial issue in case study approaches. However, case studies can be generalised (Yin, 2009; Yin, 2012; Flyvbjerg, 2006) and multiple case studies contribute to generalisability (Cohen, et al., 2011; Yin, 2009). Yin (2012, p. 6) contended that case study findings can be generalised to other situations through analytic (not statistical) generalisation. Yin (2009) elaborated

> a case study […] does not represent a "sample" and in doing a case study your goal will be to expand and generalize theories (analytic generalization) and not to enumerate frequencies (statistical generalization). (p.15) (quote and brackets in original text)

Flyvbjerg (2006) asserted that the case study is ideal for generalising using "falsification", a term he drew from Karl Popper (1959) (quotes in original text). Flyvbjerg argued falsification forms part of critical reflexivity in social science. In the quote below, he explained how case studies are ideal for analytic generalisation using falsification:

> Falsification is one of the most rigorous tests to which a scientific proposition can be subjected: If just one observation does not fit with the proposition, it is considered not valid generally and must therefore be either revised or rejected. Popper himself used the now famous example "all swans are white" and proposed that just one observation of a single black swan would falsify this proposition and in this way have general significance, and stimulate further investigations and theory building. (p. 228) (Quotes in in original text)

From this example, Flyvbjerg concluded that the case study approach is suited for identifying "black swans" (ibid.) because of its in-depth approach, and that one can generalise from a single case. This study intended to expand and build theories of change-oriented learning in socio-technical innovation adoption using CHAT and expansive learning processes.

3.5.5.2 Criteria for case study selection

I selected the case studies, using theoretical sampling which is a typology of purposive sampling. Theoretical sampling allows selection of cases that will yield greater insight into the theoretical issue(s) under investigation (Glasser & Strauss, 1967 in Cohen et, al., 2011). I chose case studies that I felt would offer a greater depth in understanding why uptake and utilisation of cook stoves is problematic.

Case studies may be selected based on the amount of information required for the problem or phenomena under investigation (Flyvbjerg, 2006) as well as on the type of information required. The following criteria guided me in selecting the case studies:

(a) *Vulnerability to impacts of climate change.* I chose to work in three climate change hotspots districts (see Chapter 1, Section 1.4) (LUANAR, 2013), within the three regions of Malawi (see Chapter 1, Figure 1.1). This choice was not based on representativeness; rather, I wanted to have wider contextual understanding of the ICS practice by focusing on different geographical areas. The three districts are vulnerable to climate change impacts (see Chapter 1, Section 1.4). *Deforestation* is among the major environmental problems that need to be addressed (ibid.).

(b) *Scarcity and availability of firewood, and types of ICSs (fixed versus portable).* Extreme or deviant cases is one strategy that allows one to achieve the greatest amount of information (Flyvbjerg, 2006). "Extreme or deviant cases are suitable for getting a point across and for development of new concepts that will be able to account for what were previously considered outliers" (Flyvbjerg, 2011, p. 307). In addition, deviant cases include the most extreme cases at either end of a continuum (Teddlie & Yu in Cohen et al., 2011), for example, availability of firewood versus unavailability of firewood. Chapita Village and Waziloya Makwakwa Village case studies are within areas where firewood is scarce, while Chilije Village case study is situated in an area close to a government controlled forest reserve (see Chapter 1, Figure 1.1) and firewood is available. This is an example of instrumental case studies underpinned by Barnes's (1993) theoretical underpinnings (see section 3.5.5.1). Another continuum lies between portable and fixed ICS. The ICS disseminated in Chapita Village and Chilije Village study sites is Chitetezo Mbaula portable ICS, whilst in Waziloya Makwakwa Village study site it is a fixed type (see Chapter 1). Further, I chose Chapita Village as one of the oldest communities where ICS were implemented in Balaka

(see Chapter 1) and the oldest among the three case studies. I chose these cases to help in deepening the understanding of contradictions within uptake and utilisation of ICS, understand and compare matters of structure and agency and reflexivity within the end-user activity systems in the three case studies.

(c) *Existence of members of the stove production/construction group.* During contextual profiling, I gathered that a stove production group was a focal point for ICS activities and a space for boundary interactions among actors involved in the ICS practice. However, some communities had defunct production groups, and it was difficult to find members of the groups. Hence, one of the criteria for selecting the three cases was where I found members of stove production groups who, had also shown interest in the project, due to its emancipatory agenda.

3.5.5.3 Selection of Activity Systems and Participants

The selection of activity systems to include in the study was guided by CHAT third generation notion of "a network of interacting activity systems". Elsewhere I have mentioned "key" activity systems or actors because there are many actors involved in the ICS practice. However, as indicated above, I used the production groups as the focal point to establish interacting activity systems. I gathered that the production group interact with the end-users, the promoter, the trainer, the implementers, yet not all these activity systems interact with the policy activity system except the implementer for Chapita and Chilije case studies. In Waziloya Makwakwa Village case study, their approach does not use promoters and trainers (see Figure 3.5). The policy activity system was also more pronounced in Chapita Village, than in Chilije Study sites, probably because the coordinator of the NCSSC resided at Balaka offices that were responsible for implementing the cook stove project in Chapita Village study site. Chapita and Chilije case studies should have the same number of activity systems because they use the same approach to ICS dissemination. However, the promoter and the trainer were not accessible (see Chapter 5, Section 5.2.3).

Purposive sampling was also used in selecting participants from the policy and implementer activity systems in order to include those that I felt had in depth knowledge (Ball, 1990) about the ICS practice in general and in working closely with the communities in particular. I planned to include one project manager or project officer and two field facilitators for each implementer activity system and a Director and Deputy Director of the DoEA for the policy activity system. However, this was not possible in all the case studies due to busy schedules at their offices. See Appendices 10 and 14 for summaries of research participants in the study in the two phases of study.

I employed random sampling initially to select participants for the end-user activity systems. Every fifth household was included for observation. However, from the observed households I purposively sampled households to proceed with interviews in order to include representatives for each of the three end-user activity systems. The number of households for observations was based on theoretical saturation (Cohen et al., 2011 and Bloor & Wood, 2006). Theoretical saturation occurs when no additional data are found that advance, modify, qualify, extend, or add to the theory developed (Glasser & Strauss as cited in Cohen et al., 2011, p. 161). I stopped collecting observational data when I reached a point where I was getting no new insights for the issues I was investigating. In terms of the stove production groups, I included all members available for group interviews. In terms of participants for the BCCLW, I also made sure to include representatives of each of the activity systems within a case study. However, the policy activity system were not available in the BCCLW, because I did not receive any response to the communications I put forward. Later I was advised that the Deputy Director of DoEA whom I was trying to communicate with was no longer in the position. Due to this, I arranged a separate meeting with members of the policy activity system during follow-up workshops at their offices in Lilongwe for a consolidation session (see Appendix 15). In Chapita Village, representatives from the implementer activity system attended only the planning meeting and the last consolidation session, despite efforts to remind them (see Appendix 3). Section 3.7.5.1 provides details on how I worked with BCCLW in two case studies.

3.6 Research Process

This section discusses the various processes that I followed during the research journey from data generation to compilation of data.

3.6.1 Gaining Access

Gaining access and acceptance is crucial in doing social research (Cohen et al., 2011; Bloor & Wood, 2006). According to Bloor and Wood (2006), achieving access involves achieving both physical access to the setting and social acceptability among the respondents. Much emphasis is on gaining permission early on in the research planning stages (Bell, 1991). When a researcher seeks permission to access the research site and research participants, they also need to get full informed consent (ibid.) (see Section 3.9.1). Bloor and Wood (2006) also pointed out that access negotiations are not one-off events, but an on-going process, which should run throughout the research process. I negotiated for access in three stages of the research process, first for the contextual profiling and during the two phases of the study, exploratory phase, and expansive phase.

3.6.1.1 Access for contextual profiling

I started the process of seeking permission to access research sites during contextual profile. I obtained a letter of introduction (see Appendix 4) about my study and myself from the registrar of Lilongwe University of Agriculture and Natural Resources where I work. I used this letter to get entry in all the institutions, NGOs, DoEA, and communities where I gathered information for a contextual profiling. Before, visiting an institution I made telephone calls, and in some cases, I followed the telephone conversation with an email. In order to gain physical access into the communities, I sought permission from the NGO responsible for implementation of ICS project in the research site. For some sites, for example in Mulanje, the institution, Mulanje Mountain Conservation Trust (MMCT) provided me with a *gatekeeper.* However, in most sites I had to go through the Village Headmen/women (hereafter Chief). From the Chiefs, I sought permission to enter the villages, take pictures, interview members of the community and record interviews. I did this by reading out the introduction letter. The Chief would then appoint a gatekeeper to take me around the community. The gatekeepers were responsible for introducing me to the research participants, and I clarified some points and sought permission from research participants to conduct interviews and observe the kitchens. For one site, I did not seek physical access for contextual profile because I did a telephone interview with representatives of a construction group, since it was during rainy season and the roads were impassable.

3.6.1.2 Access for exploratory phase

The contextual profile helped me to build rapport with potential research participants. During the exploratory phase, as a requirement by the facilitators of the CABMAC scholarship at LUANAR, I sought permission first at the District Agriculture Development Offices. I made telephone calls, followed with emails where possible to the officers responsible (see Appendix 5), NGOs working in the case studies under investigation (see Appendix 6 for sample letters) and for the DoEA. I made sure I followed the necessary procedures specific to an NGO in seeking permission before entering the community. In order to gain access into the communities, I went through the Chief. The Chief also provided me a gatekeeper usually on the first day of data collection. In Waziloya Makwakwa, the Field Facilitator accompanied me, and later I was given a different gatekeeper. I also sought permission to take pictures and interviews and recording interviews. During this time, I carried informed consent procedures (see Section 3.9.1), during which I introduced the second phase of the study.

3.6.1.3 Access for Expansive Learning phase

Negotiating access for Expansive Learning started during data collection in the exploratory phase as indicated above. When time was approaching I made telephone calls and wrote emails. Later, I convened

planning meetings at Catholic Women Organisation, Saint Gertrude Conference Hall in Balaka district for Chapita and for Waziloya Makwakwa at Saint Denis Parish Hall in Rumphi district. Informed consent procedures were carried out and project outlines for carrying out the BCCLW were developed (see Appendix 7) as an outcome of the planning meeting. As indicated in Chapter 1, I did not conduct Expansive Learning in Chilije case study because of financial constraints.

As indicated above, before the commencement of the exploratory phase I did a contextual profile, which formed part of the exploration since it helped me to have a better understanding of what was going on in the ICS practice, who the actors are and the problems they encounter in undertaking their various activities. I highlight the work I did during contextual profile, because it offered a starting point of this research, underpinned the study, and led me to use formative interventionist approaches. (See Appendix 8 for a summary of the work covered during contextual profiling)

3.6.2 Phases of the study

As indicated above, the study had two phases, exploratory and expansive phase. Table 3.5 below summarises the research activities undertaken in the two phases:

Table 3.5: Phases of the interventionist research design

Phase/period	Research Activities
Phase I: Exploration *February 2015-February 2016*	(a) Analysed documents collected from some institutions that participated in contextual profile, including Christian Aid Lilongwe Office, Department of Energy Affairs, Concern Universal Balaka, Mulanje Mountain Conservation Trust (MMCT) (b) Selected key actors to participate in the study in Chapita Village, Waziloya Makwakwa Village and Chilije Village case studies (c) Interviewed research participants from the three case studies to get a deeper understanding of both individual activity systems and the network of interacting activity systems. The second purpose was to understand how subjects within and between activity systems interact, and identify social learning interactions that take place within and between activity systems. (d) Conducted observations in the three case studies to establish the level of uptake and utilization of ICS. I observed the general surroundings, areas around households that participated in the study and their kitchens. (e) Transcribed interviews (f) Analysed the ICS practice, individual activity systems, and the interacting activity systems to identify tensions and contradictions. I also analysed the profile of uptake and utilisation, learning interactions and contradictions. (g) Selected and compiled mirror material in preparation for BCCLWs from data generated from interviews and observations
Phase II: Expansive *March 2016-March 2017*	(a) Facilitated BCCLWs and expansive learning processes in Chapita and Waziloya Makwakwa case studies (b) Held a meeting with implementers for Chapita case study to present contradictions analysed, together with selected participants of BCCLW (c) One consultation meeting with Sustainable Energy Management Unit Officer during examination of solutions (d) Presented a paper at the Cleaner Cooking Camp 2016 to share contradictions and the modelled solutions identified in Chapita case study as a process of examining solutions (e) Meeting with DoEA Alternative Energy Section for sharing, consolidation and generalisation of the new practice (f) Transcribed and analysed BCCLW data (g) Conducted follow-up workshops on the expansive learning processes in the two case studies (h) Transcribed and analysed data from follow-up workshops (i) Follow-up dialogues with a few research participants from the two case studies

Source: Jalasi, 2018

3.7 Research methods employed

Case study designs benefit from having multiple sources of evidence (Yin, 2012, p. 10). In this study, I used a number of research methods to generate data in line with the case study design. This helped me to study the ICS practice from different perspectives and achieve methodological triangulation (Bryman, 2001) (see Section 3.10.1). The methods used were also qualitative, aimed at generation of qualitative data obtained through exploratory, participatory and expansive techniques. The latter sought to facilitate the development of agency in research participants to change their everyday lives. Some methods used enabled me to obtain numerical data in order to establish the profile of uptake and utilisation of ICS as discussed in the sections below.

3.7.1 Document analysis

I analysed a number of documents to get an overall understanding of the ICS practice and the problems facing the practice. Yin (2012) argued that documents are not affected by the nature of inquiry and are neither obstructive nor reactive. Hence, I used documents to support data collected from interviews and observations. I restricted my analysis to relevant documents. Some documents came from institutions that did not participate in the study but these were collected during contextual profiling and some from the presentations made at the Cleaner Cooking Camp 2016 during the expansive phase (see Appendix 9). In working on the contextual profiling, I found that institutions had few documents to share and some documents were similar to the ones I had collected already from other institutions. In some instances, for example in the Chapita case study, even though during interviews a specific survey might have been mentioned that had recorded the level of uptake and utilisation, when I requested the document they indicated that they did not have access to the information as the consultant who conducted the survey had kept it. Similarly, in the Waziloya Makwakwa case study, the only document available, the project document, was not intended for public consumption. In Chilije case study, there were no documents to share. In general, it appeared that ICS activities were not well documented at institutional levels. I continued to collect documents throughout the study in order to stay updated of any developments around the ICS practice and to use any relevant information for completion of the study. (See Appendix 9 for a summary of documents analysed at specific phases of the study).

3.7.2 Semi-structured interviews

I employed interviews as a method for collecting data because I wanted to capture information that I could not manage to observe (Creswell, 2003). Observations (as discussed below) assisted me to capture *what* was going on in the case study sites, but not *why* it was happening, which I was able to capture through semi-structured interviews. Hence, data obtained from interviews augmented observational data and vice versa. I used semi-structured interviews, also called depth interviews (Bloor & Wood, 2006) or semi-standardised interviews (Berg, 1998) to help me gather rich and relevant data to address the research questions. According to Yin (2012), semi-structured interviews give participants flexibility to construct reality and think about their situations beyond the researcher's questions. Semi-structured interviews also allowed me to probe further (Berg, 1998) on topics of interest beyond the research participant's responses. Semi-structured interviews helped me to maximise validity of the study. Commenting on validity and semi-structured interviews, Cicourel (1964, in Bloor & Wood, 2006) argued, "the central impulse of depth interviewing is the sacrifice of reliability in pursuit of validity: the interviewer sacrifices standardization and repeatability between interviews in order to grasp more fully the social meanings of the respondent's world." (p. 104). I employed two kinds of semi-structured interviews, individual and group

interviews. Some of these were telephone interviews, for example, those conducted for follow-up dialogues.

3.7.2.1 Individual interviews

I used individual interviews in the exploratory phase to collect data from practitioners from the three case studies including Concern Universal Balaka and Dedza offices, CADECOM, Department of Forestry under Waziloya Makwakwa, DoEA in Lilongwe, promoter and trainer in Chapita case study and research participants from the end-user activity systems in the three case studies (see Appendix 10). For end-user activity systems, I interviewed the persons responsible for cooking from selected households that I had observed on the previous day (see Section 3.7.3). In most households, this person was a woman. In the entire study, only two men were responsible for cooking and these were identified in Chilije case study.

I used individual interviews to give both participants and I flexibility in terms of convenient times and places for conducting interviews. According to Yin (2012), one-to-one conversations are helpful in getting participants' involvement in the research process and help in building rapport and credibility with participants, which is crucial in provision of meaningful data. In the exploratory phase, I conducted 27 individual interviews in total in the three case studies. During the expansive phase, I interviewed the Sustainable Energy Management Unit (SEMU) officer at Concern Universal Balaka during the examination of solutions session. The purpose of the interview was to check the feasibility of the solutions we modelled during BCCLW in Chapita case study. After follow-up workshops, I conducted four telephone interviews, (which I have called *follow-up dialogues*) with some members of the BCCLW in Chapita and Waziloya Makwakwa case studies. The idea was to get some feedback on the learning processes that research participants went through and to track the progress of the outcomes of the follow-up workshops (see Section 3.7.7). Another telephonic interview after follow-up workshops was with the trainer from Chapita case study because she was not available during exploratory phase. Despite her availability during BCCLW, I needed to verify certain issues. (See Appendix 10 for a summary of the interviews conducted.)

I would like also to note that in Waziloya Makwakwa, a CADECOM project chairperson was present during interviews with end-users and stove construction group to provide some interpretation in case a participant could not understand Chichewa since the interviews were conducted in two languages, Chitumbuka and Chichewa (see also Section 3.10.4 for more details). Hence, in some interviews she responded to some questions as an informant.

3.7.2.2 Group interviews

Bloor and Wood (2006) defined group interviews as "an interview in which several respondents are simultaneously questioned by the researcher" (p. 99). I used group interviews in the exploratory phase to generate data from stove production groups in the three case studies. Group interviews helped me to generate data from several people in a short time and also provided me with historical information (Creswell, 2003) that I needed, consonant with CHAT, that emphasise the importance of historicity in understanding human activity. Group interviews have the potential to develop discussions and spark lively discussions (Bloor & Wood, 2006; Cohen et al., 2011). Since my interest was to get an in-depth understanding of the different activity systems, and how they interact, I found group interviews useful because, according to Watts and Ebbutt (in Cohen et al. 2011), group interviews can generate a wide range of responses. Group interviews can also "provide two versions of events – a cross-check – and one can complement the other with additional points, leading to a more complete and reliable record" (Arksey & Knight, as cited in Cohen et al., 2011, p. 432). In this way, group interviews maximised validity of the study. A researcher may detect how participants support, influence, complement agree and disagree with each other and the relationships between them (ibid.). Guided by this, I strategically started with end-user interviews so that group interviews with stove production/construction groups would provide me a space to follow up and develop or verify topics that I generated from the individual interviews. This enriched my data. Throughout the study, I conducted three group interviews. (See Appendix 10 for a list of interviews conducted in the study.)

3.7.3 Observation

In this study, I used observations both in the exploratory and expansive phase. During the exploratory phase, as indicated earlier, I used observations to augment interview data, and also to capture *what* was going on in the end-user activity system, the surrounding environment and broadly to obtain data for the profile of uptake and utilisation. Observations enable one to "tap into chaotic, non-rational behaviour that may be less likely to be disclosed in an interview" (McKeganey et al., as cited in Bloor & Wood, 2006, p. 71). According to Bell and Waters (2014), observations are useful in discovering whether people do what they say they do or behave in the way they claim to behave; they can reveal characteristics of groups or individuals that would be impossible to discover by other means (p. 211). With the object of my study, observations played a crucial method in clarifying the difference between uptake and utilisation, which had been conflated among some practitioners in the ICS practice (see Chapter 1, Section 1.4.6). I employed systematic or structured observations, in which I used an observation schedule (see Appendix 12 for observation schedule samples). In order to maximise validity of findings through elimination of possible bias (Bell & Waters, 2014), I involved a research assistant to assist me in the observation as

well as a photographer. Similarly, I developed an observation schedule to minimise and possibly eliminate variations that could arise based on individual perceptions of situations (Denscombe, as cited in Bell & Waters, 2014). The research assistant and I used the schedule as a framework. However, we were not limited to the schedule and were open to recording things that were not on the schedule. More importantly, by using the schedule we were able to conduct a thorough observation at every household. At the end of each day of observation, we compared notes, which helped in collection of significant aspects of the end-user activity and the environment. Bell and Waters (2014) contended that structured observations are useful as observers may have their own focus and may interpret significant events in their own way (p. 211). Cohen et al. (2011) argued, "structured observations enable the researcher to generate numerical data which can facilitate in making comparisons between settings and situations, patterns and trends to be noted…" (p. 459). I opted for structured observations because I needed to capture numerical data in order to explain the profile of uptake and utilisation of ICS in the three case studies.

As indicated in Chapter 1, the study aimed at generating an Innovative Extension and Communicative Methodology, it was necessary to generate meaningful data, from which I could draw significant patterns and trends in the uptake and utilisation of ICS for the development of the methodology. Systematic observations were useful because I had already identified objectives of my study during the contextual profile, as well as the importance of observing specific aspects of research participants' activities (Bell & Waters, 2014) (see Appendix 12) that I needed to answer the research questions, specifically questions 1 and 3. For example, the contextual profiling had led me to a conclusion that uptake was not quite problematic in Chapita and Chilije case studies, but utilisation of the ICS was unsustained. On the contrary, utilisation was not problematic in Waziloya Makwakwa case study, but uptake was a challenge.

I did observations for two days in each of the three case studies. I observed 26 households in Chapita case study, 21 households in Waziloya Makwakwa case study and 24 households in Chilije case study. I made a thorough observation on the first day in order to capture untampered information, especially in the kitchens. This is because sometimes participants may provide you with information they think you would like to hear or see (Chisoni, 2015; Lambe & Senyagwa, 2015). There is also a tendency in Malawi to paint a good picture of circumstances when being paid a visit. This has in part been due to the influence of evaluative studies. I thus avoided warning community members of my first visit. I sought consent from the Chiefs on the first day of observation so that that they would not have time to announce at night through village criers. I observed participants' kitchens and cooking places to gather information on the number and types of cook stoves a household owns, whether they use the ICS or TSF, or both, stove conditions, specifically whether the stove was cracked or intact. Additionally, I checked whether the ICS showed signs of use or not, the type of stove which was being used during my visit, fuel type used, pot

size used on the ICS, and any signs of tampering with the TSF (see Appendix 12). On the second day, I continued with observations (and conducted interviews later). The findings are presented mainly in Chapter 4, and in Chapter 6, to a lesser extent.

In the expansive phase, I used observations during BCCLWs and follow-up workshops with the aid of videotaping (see Appendix 11 for the nature of observations carried out in the study). All the sessions were videotaped. I used the recorded data for analysis after each day to prepare for the next sessions. During experimentation of some solutions, I used observations aided with video-taping to capture both the problematic situation and the new way of performing the activity (see Appendix 13, Video clip MV1_0012.MOV). The details of what took place during BCCLWs and follow-up workshops in the two case studies are discussed in Sections 3.7.5.1 and 3.7.6.

3.7.4 Group Discussions

I used group discussions during BCCLWs to facilitate modelling of solutions to some of the contradictions that participants had agreed to work on and during the planning of actions on how to experiment the new model in real life situations. Participants were divided in groups of three or four. The two research assistants and I were overseeing the groups and guiding them on the tasks in the process. After modelling solutions (see Photos 3.1 and 3.2) and after developing action plans (see Photos 3.3 and 3.4), each group presented to the entire workshop. Participants from other groups made comments. The detailed processes are discussed in section 3.7.5.1 below.

Photo 3.1: Participants model solutions in groups in Chapita Village case study (Chisoni, February 2016c)

Photo 3.2: Participants model solutions in groups in Waziloya Makwakwa Village case study (Chisoni, March 2016c)

Photo 3.3: Participants develop action plans in groups in Chapita Village case study (Chisoni, February 2016c)

Photo 3.4: Participants synchronise action plans in Waziloya Makwakwa case study (Chisoni, March 2016c)

3.7.5 Boundary Crossing Change Laboratory Workshops (BCCLWs)

Change Laboratory is a toolkit used in the implementation of formative intervention methodology (Engeström, 2015; Virkkunen & Newnham, 2013; Sannino, et al. 2016). It is used when "an activity system or a cluster of activity systems face uncertain but necessary transformation riddled with conflicting motives and energised by a possibility of reaching a qualitatively new, emancipated mode of activity"

(Engeström, 2015, p. xxxiii). BCCLW was the main methodology which I employed in the second phase of the study in order to carry out the cycle of expansive learning actions (see Figure 3.4) in two case studies, Chapita and Waziloya Makwakwa, following the surfacing of contradictions during the first phase of the study as discussed earlier. During BCCLWs, practitioners in each of the two case studies jointly studied the causes of problematic situations in their activity and developed new concepts to manage collaboration (ibid.). Through BCCLWs, I brought together practitioners from interacting activity systems to stimulate them to analyse the history, contradictions and ZPD of their activity system, to design a new model for it; and take steps towards the implementation of the model (Engeström, 2015) (see Chapter 7). This is in line with the focus of the study to work with actors in the ICS practice towards the transformation of the practice, through finding new ways of working as indicated earlier.

In order to stimulate participants to engage in the above processes I employed the principle of double stimulation (see section 3.5.1). The first stimulus was mirror data from interviews, which reflected problematic situations within the ICS practice that I collected during the first phase. This enabled practitioners to question and analyse the current ICS activity, identify and formulate contradictions. The second stimulus was the joint activity system model that enabled participants to locate the sources of the problems from the different elements of the activity system and modelled solutions for them.

The Change Laboratory was created to meet several challenges in the development of work activities (Engeström as cited in Virkkunen & Newnham, 2013). I employed the Change Laboratory method to meet the following challenges as proposed by Engeström that the ICS practice is facing as described in Chapter 1:

(a) To bring together practice-driven redesign of processes and idea-driven construction of visions for the future-new dialectic of specific improvements and comprehensive visions.

(b) To bring the multiple parallel rhythms of development in work to closer interaction – a new dialectic of long, medium and short cycles of change.

(c) To bring together the resources inherent in the existing work practices and the new ideas and concepts used to take up new challenges and to develop new products and services – a new dialectic between tradition and innovation[24] (Virkkunen, Engeström, Helle, Pihlaja & Poikela, as cited in Virkkunen & Newnham 2013, p. 24).

The method of Change Laboratory is "applicable in different kinds of cultural contexts" in which "participants can freely express their opinions" (Virkkunen & Newnham, 2013, p. 26). It has been carried

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[24] A new dialectic between tradition and innovation is also a key feature of Education for Sustainable Development (Tilbury, 2011; Lotz-Sisitka, 2017; O'Donoghue, 2016).

out in different activities (ibid.) in different parts of the world. In southern African environmental education research, for example, the Change Laboratory method has demonstrated its potential for transformative praxis through resolving contradictions among interacting activity systems (Mukute, 2010; Masara, 2011; Lindley, 2014; Kachilonda, 2015; Baloi, 2016).

3.7.5.1 Employment of Boundary Crossing Laboratory Workshop in the Study

I conducted BCCLW in eight days, four days in each of the case studies. I conducted two sessions in a day, one in the morning, and one in the afternoon. Each session lasted approximately three hours. This was in part to give time to participants to deliberate on the issues; at the same time, participants were not familiar with the mode of working in the workshops (see Section, 3.10.4). In total, I facilitated eight BCCLW sessions in each of the two case studies (see Appendix 14). In between sessions, participants were given tasks to complete at home in order to speed up work, and at the same time, allow participants enough time to deliberate on issues during the sessions. In the Chapita case study, I also conducted two meetings in between sessions and made one presentation at the Cleaner Cooking Camp 2016. Additionally I conducted follow-up workshops, usually referred to as follow-up sessions (see Section 3.7.6) and follow-up dialogues (see Section 3.7.7) for each of the case studies.

Nineteen people participated in the BCCLWs in Chapita case study. Members were drawn from seven activity systems instead of eight as planned. They included implementer activity system, stove production group activity system, promoter activity system, trainer activity system, ICS user activity system, TSF user activity system and TSF and ICS user activity system. There was no representative from the policy activity system as planned; I did not get response from the communications made as indicated earlier. Additionally, the Field Facilitator representing the implementer activity system only participated in the planning meeting. During reflections, participants expressed their disappointment in the absence of the implementers and felt that this had implications on the deliberations due to the nature of the contradictions identified. As a result, participants organised a meeting between sessions 4 and 5 with the Field Facilitator to brief him on the progress made, seek his input before proceeding with modelling solutions and request attendance at the remaining sessions. However, he never attended the subsequent sessions. Apart from representatives from the activity systems, there was a member of the Village Development Committee from Chapita village and a practitioner from CADECOM Balaka office. Participants proposed to include the members during the planning meeting. In session 5, we had a new trainer; participants felt that with the nature of the contradictions identified and the focus of session 5 in modelling and examining solutions, we needed the expertise of the trainer who was responsible for training the production group. The trainer was not available at the beginning of the study, nor at the beginning of the expansive phase. Other

members included the researcher interventionist and two-research assistants (see Appendix 14 for more details).

In the Waziloya Makwakwa case study, 15 people participated in the BCCLWs. Participants were drawn from five activity systems. They included implementer activity system, stove construction group activity system, ICS user activity system, TSF user activity system, TSF and ICS user activity system. However, the Project Manager and Project Officer from CADECOM only participated in the planning meeting, and were not available in the subsequent sessions. Other members included a CADECOM project chairlady from the case study site, two research assistants and one researcher-interventionist (see Appendix 14 for more details on how the sessions were conducted).

In carrying out the BCCLW, I used a number of conceptual tools (see Photo 3.5) to support the learning process including the 3x3 set of surfaces adopted from Engeström, Virkkunen, Helle, Pihlaja and Poikela, 1996, p.11). The surfaces have three columns horizontally, which are used to represent the joint activity on different levels of abstraction and theoretical generalisation, and vertically the surfaces are divided into three rows representing the past, present and future of the activity; they are used to help participants "share and jointly process their observations and ideas" (Virkkunen & Newnham, 2013, p.15). I also used the phases of the Change Laboratory process adopted from Engeström et al. (1996, p. 11) to guide participants through the learning process. The typical sitting arrangement during BCCLW is depicted in Photo 3.6. The researcher-interventionist was the facilitator; she was also writing on the flipcharts a number of times in the process of facilitating the process despite scribes having been appointed.
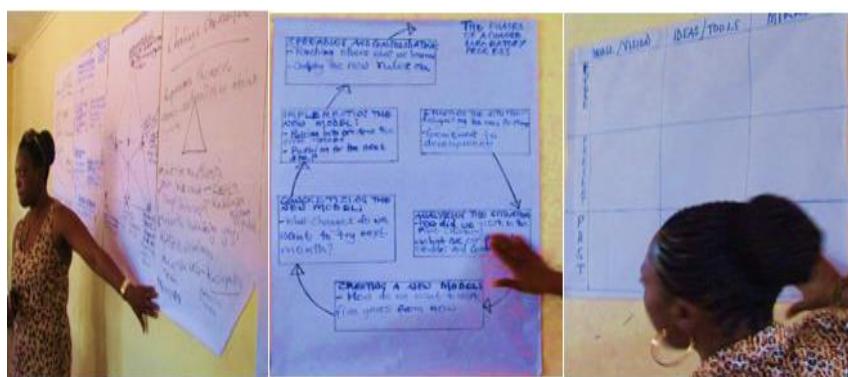
Photo 3.5: Some conceptual tools used during BCCLWs (Chisoni, 2016c)

Photo 3.6: A typical sitting arrangement in the BCCLWs in Chapita Village case study (left) and Waziloya Makwakwa Village case study (right) (Chisoni, 2016c)

3.7.6 Follow-up workshops

After the initial experimentation and implementation of the new model, I carried out follow-up workshops (typically called follow-up sessions in Virkkunen and Newnham, 2013, and feedback workshops in Mukute, 2010) in the two case studies between three and four months after the last BCCLW session. However, in the Chapita case study, I made a follow-up meeting a month after the last BCCLW (see Appendix 11) to clear some misunderstandings that had arisen in the division of labour within the stove production group activity system. The confusion came because of the creation of new roles and taskforces to drive the initial experimentation and implementation processes. However, nobody voiced concerns and I left without addressing the issue. Instead, participants presented the progress made on the tasks created during the BCCLWs, discussed emerging problems in the implementation process and devised plans on how to deal with some of the problems, as well as how to continue with the experimentation plans (see Appendix 15).

The purpose of the follow-up workshops was to complete the cycle of expansive learning. Participants engaged in reflection of the learning process, consolidation of the new version of the future forms of activities and planned how to spread the new tools and forms of actions (Virkkunen and Newnham, 2013) (see Chapter 7). (See also Appendix 15 on how I conducted the follow up workshops.) In addition, I used follow-up workshops to track the progress made on the experimentation process, to receive new types of contradictions in the experimentation of the solutions and to strengthen the basis for developing an Innovative Extension and Communicative methodology, as indicated earlier. In each case study, I conducted two-day workshops, which had similar arrangements to the BCCLWs. Additionally, there were some activities carried out before, in between and after the follow-up workshops. In Chapita case study, a day before the workshops, I visited the community to observe some of the experimental activities and the day after the last session, we experimented on cooking *nsima* with support (Chapter 8, Photo 8.3, and Appendix 15). This was because the best solution chosen by research participants for the

problematic situation was beyond the scope of the study (see Chapter 7, Section 7.2.6.1). On the other hand, cooking with support as a solution was not preferred initially.

Five days after the experimentation, I conducted a meeting with the Alternative Energy Section at the DoEA. The purpose was to share the findings of the study, spread the new tools and actions, which came out of the expansive learning processes (see Appendix 15) and seek input on the findings of the study, since the policy activity system was not present during BCCLW. In Waziloya Makwakwa case study, after the first day of the workshop, we visited the community to observe experimental activities, the day after the last session as we had planned to make final corrections on the roadmap that participants created during the consolidation session. However, we engaged in a questioning process on one contradiction that participants had decided to drop during the early sessions of BCCLWs.

Participants of the follow-up workshops were expanded in both case studies. This was due to the developments that had taken place during the implementation process, as well as the expertise that participants felt that they needed in developing the roadmap document. In Chapita case study, we had two representatives from the new members of the newly revamped stove production group and the forestry extension officer who works with the community in the study area on Day 1. On Day 2, the SEMU officer from Concern Universal representing the implementers joined us. In Waziloya Makwakwa case study, we had the Health Surveillance Assistant from the study site area (Ehlonipeni area) on Day 1. On Day 2, a Forestry Assistant from Mpherembe and the Project Officer from CADECOM joined us. Participants at the Alternative Energy Section included two Energy Officers, two Energy Assistants, and one Country Assistant Energy Officer.

3.7.7 Follow-up dialogues

I also conducted follow-up dialogues with a few members from both case studies. I used follow-up dialogues to get more feedback on the learning processes and to track the progress in the implementation of the new consolidated form of activity. The dialogues were important in that I was able to understand better how the participants' agentic expressions had materialised into agentic actions after several months. This is because there was not enough time between the series of BCCLWs and the follow-up workshops to allow participants to make tangible developments in the new practice. I had three dialogues in Chapita case study (two telephonic and one face-to-face). The telephone dialogues were conducted six months after the follow-up workshops (December 2016) and the face-to-face after 9 months (March 2017). During the same time, I made observations in the community on some developments that had taken place. In Waziloya Makwakwa case study, I had one follow-up dialogue six months after the follow-up workshops (see Appendix 10).

3.8 Data analysis

Data analysis started early on in the study. Deeper analysis of problematic situations and observed phenomena started in the field during mirror data generation and BCCLW where research participants were involved in historical and empirical analysis of contradictions. In analysing interviews, I started with each interview, then all interviews in each activity system, then all activity systems in each case study, then across case studies. Analysis of BCCLW was done session by session in each case. The study draws on critical realist analysis framework (Danermark et al., 2002) using inductive, abductive and retroductive analysis.

3.8.1 Data processing and coding

After data generation, I transcribed all interviews and BCCLW discussions in the languages they were generated, Chichewa and English for Chapita Village and Chilije Village case studies, and Chitumbuka, Chichewa and English for Waziloya Makwakwa case study. I then translated only the excerpts that I used in the writing up of the thesis.

After transcriptions, I proceeded with coding. Coding involves organising material into categories and labelling the categories before bringing meaning to the data in preparation for analysis (Merriam, 2001, Creswell, 2003; Maxwell, 2009). I categorised data using theory (Maxwell, 2009), concepts from the data (Merriam, 2001) and language of research participants (Creswell, 2003). The theoretical categorisations were derived from CHAT's second generation activity system, which formed the basis for analysis of individual activity systems, as well as from social learning and learning theories, as discussed in the first part of the Chapter (see Sections 3.4.1, 3.4.2, and 3.4.4). In terms of observation data, I used the observation schedule (see Appendix 12) to develop categories. In the construction of categories I was mainly guided by Day, as cited in Merriam (2001), who explained that, category construction

> … means breaking data down into bits of information and assigning "these bits to categories or classes which bring these bits together again if in a novel way…. In the process, we begin to discriminate more clearly between the criteria for allocating data to one category or another. Then some categories maybe subdivided and others subsumed under more abstract categories. (p.180)

After transcribing interviews from the first phase, I coded all the interviews using manual colour coding. I generated categories focusing on problematic situations inherent in activity systems within uptake and use of ICS as described by research participants. This process led me to generation of mirror data, which I presented to participants during BCCLW. I also coded the same interviews in preparation for analysis of research questions 1 and 2. In the second phase, I followed the same process, but this time using data generated from BCCLWs, follow-up workshops, and follow-up dialogues in preparation for analysis of expansive learning (see Chapters 7 and 8).

3.8.2 Index coding

In reporting findings, I used several codes to identify research participants and their activity systems, and to identify data sources. To identify research participants in the end-user activity system I used their activity systems followed by initials to differentiate one research participant from the other within the same activity system, (e.g. *ICS user FJ*). Sometimes during interviews a spouse or another person would join in the conversation; in that case I identified them with the code for the research participant and a superscript number (*e.g. ICS user FJ²*) to differentiate them from the main research participants. Members of production/construction group were identified as stove producer/ stove constructor with a number in front (e.g. *stove producer 1*) to differentiate one producer from another. In Chapita and Chilije case studies, they are called stove producers, while in Waziloya Makwakwa case study they are called stove constructors. I identified the rest of research participants with their roles or positions, *(e.g. Stove promoter or Project officer).* However, whenever there were more than one, for example, two Field Facilitators within the case study, I used initials to distinguish them, *(e.g. Field Facilitator LM)*. In reporting BCCLWs findings except for participants with specific roles such as Field Facilitators and Deputy Directors, all participants are identified with their initials (*e.g. Participant EC*).

In order to differentiate data sources from the three case studies I used the data source followed by district short forms, then a number to differentiate an interview or a session, or meeting etc. For Chapita case study in Balaka district, I used **BK,** for Waziloya Makwakwa case study in Mzimba district, I used **MZ**, and for Chilije case study in Dedza district, I used **DZ.** Table 3.11 provides the details and examples. In addition, I used symbol **#** to refer to speech turns in the video data from BCCLWs for Chapters 8 and 9.

Table 3.6: Index Coding for Data Sources

Data source	Data source Code	Example
Individual interview	Interview	Interview DZ1
Group interview	GP interview	GP interview DZ1
Contextual Profiling	CP	CP BK
Boundary Crossing Change Laboratory Workshop	BCCLW	BCCLW MZ 1
Follow-up Workshop	FUW	FUW BK 1
Follow-up Dialogue	FUD	FUD MZ 1
Consultation meeting on Feasibility of solutions	CM	CM BK1
Briefing meeting on workshop progress	BM	BM BK1
Panning meeting on workshops	PM	PM MZ1
Follow-up meeting	FUM	FUM BK1
Follow-up community visit	FUCV	FUCV BK1
Experimenting with solutions	ES	ES BK1
Follow-up closing session	FUCS	FUCS

Source: Jalasi, 2017

3.8.3 Analytical Framework

The study employed a critical realist framework, using inductive, abductive and retroductive modes of inferences. This is line with the critical realist theoretical framing, as well as the object of the study to understand and explain why uptake and utilisation of ICS in the three cases studies is the way it is, as described in Chapter 1, Chapter 2 and Chapter 4. It also resonates with the emancipatory agenda of the study through identifying and explaining causal mechanisms influencing contradictions, in order to seek solutions for problematic situations beyond the empirical level. In order to explain the analytical framework, I drew largely from the work of Danermark, Ekstrom, Jakobsen and Karlsson (2002).

In order to explain something from a critical realism perspective, one needs first to describe and conceptualise the properties and causal mechanisms generating and enabling events that make things happen and then describe how different mechanisms manifest themselves under specific conditions (Danermark et al., 2002, p. 74). To engage in this kind of investigation, one requires a methodological and analytical approach based on abduction and retroduction besides induction (ibid.). Danermark et al. emphasise that the modes of inference are complementary and that these three modes are synthetic in that they add new knowledge about reality beyond what is in the premise (p. 85). Inductive analysis enables us to see similarities in a number of observations and draw conclusions that these similarities also apply to non-studied cases (ibid., p.80). For example, the non-studied cases may be individual households of the end-user activity system that might be facing constraints in the cooking of *nsima* on the ICS. However, inductive analysis does not provide us with the means to identify underlying structures and mechanisms (ibid.). Abduction and retroduction thus helped me in seeking knowledge of structures and mechanisms that were not given in empirical data. Abduction involves redescription or recontextualisation of individual phenomena within a conceptual framework (theory) or a set of ideas (ibid, p. 80). It allows one to understand something in a new way by observing and interpreting that something in a new framework (ibid.), e.g. the CHAT activity system framework. Recontextualisation enabled me to discover connections and relations that were not directly observable; it also enabled me to understand and explain already known occurrences in the ICS practice in a new way (ibid.). This study has explained the connections between learning, uptake, and utilisation of ICS through abductive analysis. In order to go deeper with the analysis, I employed retroductive analysis, where I sought to clarify the basic conditions for people's actions, reasoning and knowledge (Danermark et al., 2002, p. 96). Conditions are the circumstances without which something cannot exist (ibid., p. 96). Retroductive analysis is primarily concerned with explaining what must have happened for things to be the way they are (ibid.). The core of retroduction is transcendental argumentation (see Section 3.2.2.1). As indicated

earlier, the three modes of inference are complementary and in employing them together, I was able to arrive at a more elaborate explanation of the ICS practice through answering the research questions.

Chapter 4, which answers the question, *What is the profile of uptake and utilisation of cook stoves in the three case studies?* used inductive analysis, which allowed data to express the situation in the field the way it was, both quantitatively and qualitatively in order to augment quantitative data.

Chapter 5, which answers the questions, *What learning interactions take place among improved cook stove technology actors?; How do the actors learn ICS technology?;* and *What do they learn during interactions?* used a combination of inductive and abductive analysis. I used CHAT's second and third generation activity systems to analyse the interactions, and learning interactions taking place within and between activity systems. I also drew from Blackmore (2007) and Engeström (2009) who provided me a framework to define a learning interaction. Using the three questions: Who is learning? What do they learn? How do they learn? (see also Section 3.4.2), I identified the subject of the learning in each interaction and the content of the learning. Then I drew from several learning theorists to understand how the subjects learn (see Section 3.4).

Chapter 6, which answers the question, *What contradictions exist in the uptake and utilization of improved cook stoves in the three case studies?* uses abductive analysis through CHAT and retroductive analysis using critical realist conceptualisations to explain causal mechanisms that caused the contradictions.

Chapter 7, which answers the question *How can learning interactions within and between activity systems be expanded to facilitate sustained uptake and utilisation of ICSs?* used abduction through CHAT and expansive learning using the concept of double stimulation, ZPD, germ cell and ascending from abstract to concrete.

Chapter 8, which answers the questions, *What interaction model can be developed from the study to guide future interactions? What methodology can be developed from the study to facilitate ICS technology sustained uptake and utilisation?* uses a combination of inductive, abductive and critical retroductive analysis. In employing intensive analysis of the Expansive Learning processes, I used inductive and abductive analysis. I drew categories for reflective talk analysis from concepts deriving from data. Abduction analysis was informed by Abercrombie, Hill, and Turner, as cited in Mukute (2010) conceptualization of reflexivity (see Section, 3.4.1). Further, for transformative agency analysis, I drew from Hapasaari et al. (2014) and Kachilonda (2015); for boundary interaction analysis, I drew from Engeström (2008). I also drew from Sannino's (2015a) Vygotskian double stimulation model, as a framework to map out Transformative Agency Pathways (TAPs) for an integrated intensive analysis of the expansive learning (see Chapter 8). I used critical retroductive analysis by synthesising issues

emerging from analyses of all the chapters to develop the Innovative Extension and Communicative Methodology (see Chapter 9).

3.8.3.1 Intensive analysis of Expansive Learning: Mapping Transformative Agency Pathways

In order to demonstrate how research participants had learnt during expansive learning processes and how learning interactions had been expanded among members from interacting activity systems present during the BCCLW, I employed an integrated analysis including reflective talk analysis, transformative agency analysis and boundary interaction analysis. I demonstrated this using four Transformative Agency Pathways (TAPs), discussed in detail, two from each case study using participants' own words using data obtained from BCCLWs. I selected TAPs that I was able to carry further in resolving the conflict of motives (see Chapter 9, Figure 9.1) in order to provide a good basis of reflexivity, transformative agency expressions and modes of interaction among participants during BCCLWs. The remaining TAPs have the same level of detail, however, I summarised them because a microanalysis of all the TAPs is beyond the scope of this study due to the level of detail that needs careful work and time. This will constitute post-doctoral work. The sections below provides theoretical underpinnings of the analyses employed. (See Chapter 8 for theoretical underpinnings of Sannino's (2015a) Vygotskian double stimulation model.)

The analysis was based on data collected from BCCLWs and follow-up workshops. However, for the Chapita case study, I included the three meetings organised in between sessions (see Appendices 14 and 15) because they involved the implementer and policy activity systems who were important in the joint activity, but were not available during BCCLWs as indicated earlier. The interest for the scope was to track TAPs from decision formation to implementation (see Chapter 8, Section 8.2).

Reflective talk analysis: As indicated earlier, reflexivity involves three aspects: (1) the ability to look into oneself, (2) to examine one's own practice and change it, and (3) the ability to reflect on and talk about the social world (Abercrombie et al., as cited in Mukute, 2010). Additionally, Mukute (2010) defined reflective talk as "a talk that shows that something has been learnt from practice and is going to improve the practice or enhance individual or collective agency" (p. 313). These elements will guide tracing evidence of reflective talk from BCCLW data. As pointed out earlier (see Section 3.4.1), Brall et al. (2007) argued that reflective learning involves the production of new knowledge. I used reflective talk analysis to understand how the expansive learning process had stimulated reflexivity in the participants – how the participants had reflected on their actions and ideas and how this would lead to new understandings (Dyball et al., 2007) of their practice, decision formation and decision implementation for sustained expansion in the practice. According to Brall et al. (2007), various models of learning integrate reflection as a constitutive element: they cited Kolbs' (1974) Experimental Learning Cycle, Nonaka's and Takeuchi's

(1995) Knowledge Creation Model, Crossan's et al. (1999) and Engeström's Expansive Learning Cycle. They emphasised "the core element to optimize processes sustainable is reflection" (unpaged).

Transformative agency analysis: I used the typology of transformative agency expressions to categorise and analyse participants' conversational data (see Table 3.2). With the exception of number seven, the first six types of transformative agency typically appear in combinations that evolve over time, moving from rudimentary expressions of resistance and criticising toward envisioning, committing and taking consequential change actions (Hapasaari et al., 2014, p. 5). Significant for southern Africa, and for Malawi, is a finding from the study of Kachilonda (2015) which was undertaken in Malawi. He commented on the significance of power relations in enabling or constraining expansive social learning and added confronting and navigating power relations as a key form of transformative agency expression. He argued that "recognition and voicing of power relations among participants is also a process of transformative agency expression" (p. 332). This finding reflects similar comments from southern African researchers who commented on their observations of skilled negotiation of power relations in the emergence of transformative agency (Mukute, 2010; Masara, 2011). Given its apparent significance in a southern African context, and especially also in relation to the 'top-down' problem within dissemination of ICS, I included this in the transformative agency analytical framework that I used since the ICS practice involves practitioners representing a cross-section of authorities. Sannino (2008b) argued, "the talk through which participants commit to something practical belongs to commissive speech acts" (p. 247). This type of talk is similar to committing transformative agency expression. Sannino elaborated, "discourses have transformative power and through the movement from one speaking turn to another it is possible to transform individual commitment into a joint commitment in a CLW" (ibid., p. 248). This analysis enabled me to trace the emergence of transformative agency in the participants, towards re-conceptualisation of their object.

Boundary interaction analysis: The analysis of types of interaction among participants in expansive learning is a fruitful way to include the horizontal aspect of learning in concrete investigations (Engeström, 2015). A framework of three basic types of interaction: (1) Coordination (2) Cooperation (3) Reflective communication (see Figure 3.6) has been used to capture the dynamics of collaboration in processes of problem solving and learning (ibid.). For example, Engeström (2008) used it in the analysis of interaction in a court trial, while de Lange (2011) used it in his work on '*Formal and non-formal digital practices: Institutionalizing transactional learning spaces in a media classroom'.* The framework makes visible the shifts in participants' orientation towards one another and towards the object of their learning efforts simultaneously (Engeström, 2015, p. xxiv). It allowed me to trace an expansive transition from one type

of interaction to another (Engeström, 2008) from conversational data obtained only from BCCLWs and follow-up workshops.

I used this analysis to see how the participants were moving towards collaboration in their work. One of the objects of this study is to enhance boundary interaction between activity systems in order to create space for sustained interaction and learning, as indicated earlier. The interaction analysis helped me develop an interaction model for future interaction (de Lange, 2011) potentially to be used between activity systems to ensure sustained interaction and learning (see Chapter 8). Brall et al. (2007) argued it is important to build up situations in a systematic way, in which people exchange and question knowledge and come to new collective knowledge through face-to-face contacts using verbal or visual communication. In a similar way Engeström and Miettienen (in de Lange, 2011), pointed out that Activity Theory needs to develop tools for analysing and transforming networks of culturally heterogeneous activities through dialogue and debate.
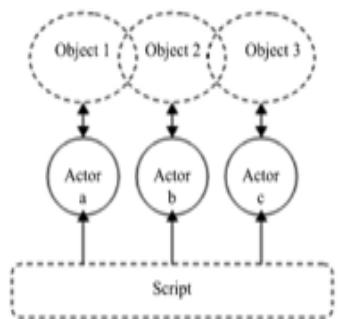
| Figure 3.6A | Figure 3.6B | Figure 3.6C |
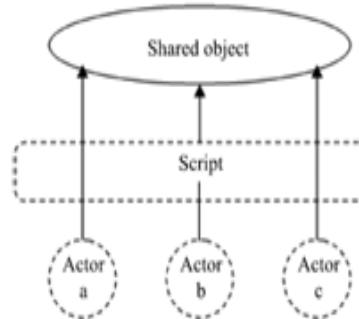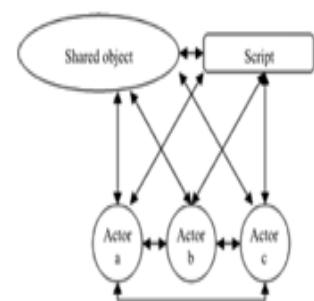
Figure 3.6: Three modes of interaction
Source: Engeström, 2008, pp. 50-51

Figure 3.6A is the *general structure of coordination*, Figure 3.6B is the *general structure of cooperation* and Figure 3.6C is the *general structure of reflexive communication*. According to Engeström (2008, pp. 50-51), the **unbroken** boundaries indicate that the entities are the focus of the subjects' critical attention. The **broken** boundaries indicate that the corresponding entities are not the focus of the subjects' critical attention. In Figure 3.6A, the **script**, coded in written rules, plans and instructions or engraved in tacitly assumed traditions, coordinates actors' actions as if from behind their backs, without being questioned or discussed (ibid.). On the other hand, in Figure 3.6B, the actors, instead of focusing on performing their assigned roles or presenting themselves, focus on a shared problem, trying to find mutually acceptable ways to conceptualise and solve it. The participants go beyond the confines of the given script, yet they do this without explicitly questioning or re-conceptualising the script. In Figure 3.6C, the actors focus on re-conceptualising their own organisation and interaction in relation to their shared

objects. Both the object and the script are re-conceptualised, as is the interaction between the participants (ibid.). Engeström, however, maintains that the interaction as depicted in Figure 3.6C is rare.

Engeström (2008) elaborated that the mechanisms of transition between the levels are *disturbances, ruptures* and *expansions.* Disturbances are unintentional deviations from the script. They cause discoordination in the interaction, which in turn may lead to disintegration (e.g. confusion and withdrawal), contraction (e.g. by authoritative silencing of some actors or by softer evasion), or expansion, that is collaborative reframing of the object by moving to cooperation or communication. Expansions may also occur without being triggered by immediately preceding disturbances. Whereas disturbances are deviations in the observable flow of interaction in the ongoing activity, ruptures are blocks, breaks, or gaps in the inter-subjective understanding and flow of information between two or more participants of the activity. Ruptures do not disturb the flow of the work process, although they may often lead to actual disturbances. Disturbances, ruptures, and expansive transitions are important manifestations of the ZPD of the activity system (ibid., p. 52).

3.9 Research ethics

According to Creswell (2003), ethics entail protecting the individuals and sites of the study and the study should benefit the individuals being studied (p. 63). Cohen et al. (2011) contended that ethical issues should be interpreted in the light of the research context and other values at stake (p. 84). I practised situational ethics, which entails doing what is right depending on the context (Simon & Usher, as cited in Cohen et al., 2011). I followed several ethical procedures as follows.

3.9.1 Informed consent

Informed consent involves procedures followed by a researcher in which research participants choose whether to participate in the research after being informed by the researcher of the facts that would help them make decisions on whether to participate in the research (Cohen et al., 2011). Understanding informed consent in this way involves taking into consideration four elements: *voluntarism, competence, full information,* and *comprehension.* This study employed all the elements. I gave participants freedom to choose to take part in the research and to withdraw at any time, which Cohen and colleagues, called voluntarism. Voluntarism also guarantees that exposure to risks is undertaken knowingly and voluntarily (ibid.). I ensured this through providing all necessary information pertaining to the study and its two phases and the actions that would be required of the research participants. However, I did not explain that the study was primarily to investigate why utilisation of ICS was problematic, specifically to potential users. My explanation was general as my investigation was concerned with both TSF and ICS and the problems they face. I did this to avoid bias in the results. Ruane, in Cohen et al., (2011) argued that for

the sake of research integrity, it is not important to provide the research purposes or contents, because this kind of information may confuse participants and may bias the results (p. 78). It may also disturb the natural behaviour of participants (Oliver, in Cohen et al., 2011). In working with different groups of people, I made sure to explain information in ways that all groups participating in the study understood all research procedures and activities. Before the interviews, I asked research participants to explain which language they would feel free to express themselves fully in. Hence, I worked with three languages, Chichewa, Chitumbuka and English. My proficiency in Chichewa can be described as *native speaker*, English as *almost native speaker* and my comprehension in Chitumbuka also as *almost native speaker* and my production level was good.[25] Competence implies that responsible, mature individuals will make correct decisions if they are given the relevant information (Cohen et al., 2011, p. 78). This was achieved through provision of relevant information for the study as explained above and participants' decisions were based on the information that I provided them (see Appendix 16).

3.9.2 Anonymity and confidentiality

Following the provision of relevant information to participants, I requested them to sign a form (see Appendix 16). The signing entailed agreement to participate in the research and granted me permission to record conversations, take pictures and videos and to use the pictures and videos in the reporting of my findings. In undertaking this, I assured research participants of protecting their right to privacy, by keeping their identities anonymous and by promising confidentiality. This according to Cohen et al. (2011) entails not revealing information provided by participants in ways that would reveal their identity (anonymity) and restricting access to data, which identifies participants, or making a participant traceable (confidentiality). This was particularly crucial in BCCLWs when I presented mirror data. I presented excerpts in ways that participants could not be identified. In reporting the findings, I have used index coding to hide the names of research participants. However, participants had agreed that I could use their pictures for the purposes of the research.

3.9.3 Non-maleficence

The principle of non-maleficence presupposes research ethics. It means that research should not damage participants at all, physically, emotionally, professionally, personally, psychologically and so on (Cohen et al., 2011, p. 85). It requires that both participants and the researcher consider carefully the possible consequences of research on both the researcher and the research participants (ibid.). I made sure I protected research participants from any harm that I was aware of. I provided participants transportation to and from the venue of BCCLW and provided them with food during the workshops. The

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[25] My production was good but slow because I had forgotten the language usage, since I had not spoken the language for a long time.

venues where BCCLWs were taking places were left intact in both cases. However, some ethical dilemmas arose during fieldwork. I have described these below (see Section 3.9.5) and how I navigated the situations.

3.9.4 Beneficence

Beneficence is also an ethical principle that I took into consideration. As discussed earlier, this study has an emancipatory agenda, which was achieved through the expansive learning processes, that helped participants to find solutions to some of the problems they faced in their interaction with the ICS (see Chapter 7). According to Cohen et al., (2011) beneficence begs the question as to how the research participants may benefit from the research. The benefits may include educational and social benefits, for example, increased self-awareness in the participants. The authors elaborated that the difference is whether the research is *for* the people and the issues or *about* people and issues (emphasis in original). This study was learner-centred. Engeström & Sannino (2010) contend that the theory of expansive learning puts the primacy on communities as learners (p.2). Expansive learning processes increased self-awareness in research participants on the object of their activities. I also contributed with research funds towards construction of a small house (see Chapter 7, Photo 7.6) for making ICS which was part of the solutions to some of the problems encountered within the stove production activity system (see Chapter 7).

3.9.5 Ethical dilemmas

As indicated above ethics are 'situated'; they have to be interpreted in specific situations (Simon & Usher, in Cohen et al., 2011). I found the concept of situated ethics useful as I navigated the following ethical issues during fieldwork.

In the Chapita case study, one contradiction that was identified related to the issue of misappropriating incentives intended for promoting ICS uptake (see Chapter 6, Section 6.3.3.3). However, participants felt that because the issue concerned senior leadership in the community, we should not model solutions for the contradiction. Despite my study's focus being to absent ills of this nature, I had to balance this need: my role as interventionist researcher and the possible negative consequences for undertaking the process of modelling solutions. We ultimately decided to drop the modelling of solutions for the contradiction.

In the Chapita case study, one of the processes for modelling a solution to contradictions that concerned the slowness of the stove in cooking and the difficulties encountered when cooking on the Chitetezo mbaula was to ask representatives of the BCCLW to present some of the concerns and proposed

solutions at the Cleaner Cooking Camp (CCC) 2016. However, due to language problems (as the conference was international), we decided to send my research assistant instead of the representatives chosen by the workshop participants. One of the promoters though, attended the CCC on a different ticket. When she came back, she requested that I did not reveal to the other participants her attendance. When I presented to the group what transpired at the CCC, in the absence of the research assistant, we pretended she was not available at the CCC, even though her input could have benefitted the group.

In the Waziloya Makwakwa case study, I arranged transportation for the community members from a specific point near the village to the BCCLW venue and back. However, at one of the sessions as we were reflecting on the process and how things had been progressing, the women complained that they were getting home late and that one participant who was older in the group felt sick on the way because of walking a long distance. When I enquired, I was told they were picked and dropped at a point far from the village, instead of where we had arranged. I then probed from the Field Facilitator who assisted me in making transport arrangements to understand what was going on. This provoked some tension and long discussions between the Field Facilitators who then came back to me with a raised transportation cost. I advised the women to inform me should the issue arise again.

In both case studies, participants preferred cash as a lunch allowance. However, this was against the principles of the scholarship; it is considered unethical conduct as it appears that one is paying the participants to participate in your research. However, participants expressed concern that there would be no point for them to buy *nsima* for the amount and consume it alone whilst their dependents have no food and that spending that money on *nsima* only for one person was inconsiderate of their needs. I clarified my position by explaining that the money was not "a pay, but it was *nsima*". I emphasised this every time they signed for lunch allowance.

Similarly, in the Chapita case study, one of the solutions modelled was to revamp the production group and new members joined. They needed to be trained in stove production. The trainer was part of the BCCLW but was not willing to do the job without receiving some money. In order to drive the developmental agenda, I gave her money for transport from her place to the venue and I asked community members to cater for her food.

The nature of the solutions we modelled resulting from the nature of problems we were dealing with, aggravated by the social-economic status of the communities as indicated in Chapter 1, especially in Chapita case study, needed seed money to implement solutions. For example, for constructing a house for stove production and conducting Controlled Cooking Test demonstrations (see Chapter 7, Sections 7.2.5 and 7.2.6.2), I needed to provide money to the BCCLW research participants assigned for the task,

to purchase food items for the demonstrations. It is in this way that situational ethics played a big role in my study, to navigate the ethical dilemmas I encountered.

3.10 Research validity

Validity requires that researchers seek to ensure internal coherence among the components of the study, the integration of events being studied in their social context and use of data for assessing the conclusions (Seale, as cited in Maxwell, 2012). For example, the researcher needs to ensure appropriateness of the methods of the research for the nature of the questions being asked, through to the theoretical justification of cases or participants in the study (ibid.). I have achieved this at study design level; I have identified theoretical and methodological approaches that have helped me to address the research problem and research questions. The formative interventionist research approach using CHAT's DWR and use of BCCLWs have allowed for the investigation of learning, as well as potential development of new human activity through expansive learning processes. I have also further ensured internal coherence by working with a case study approach and I have carefully selected and theoretically justified the selection for the cases. The methods that I have used to collect data are in line with the research questions and with generally accepted methods for case study research. As I conducted the research, I also ensured validity. Several strategies have been proposed to check accuracy of research findings from the standpoint of the researcher, the participants, or the readers of an account (Creswell, 2003; Maxwell, 2009; Teddlie & Tashakkori, 2009). However, as Maxwell (2009) pointed out, the more helpful way is to use strategies that are best in dealing with specific validity threats. Creswell (2003) argued for increasing validity by employing strategies that can help in checking accuracy of findings. In this study, I employed several strategies to maximise validity of research findings, which are discussed below.

3.10.1 Triangulation
Maxwell (2009) described triangulation as "collecting of information from a diverse range of individuals and settings using a variety of methods" (p. 245). This resonates with Denzin (1970), as cited in Bryman (2001), who described four basic types of triangulation; however, he asserted that the emphasis has tended to be on methods of investigation and sources of data (p. 275). Triangulation reduces the risk of chance associations and of systematic biases due to specific method (Maxwell 2009, p. 245). It allows a better assessment of the generality of the explanations that one develops (ibid.). Regarding methodological triangulation, I employed several methods as described above. The different methods provided me the opportunity for cross-data consistency. In the case of data triangulation, I used different participants as sources of data, from the different activity systems in the ICS practice ranging from

government officials to NGO practitioners to the grassroots. This ensured that I obtained information from multiple perspectives and hence obtained a higher degree of accuracy.

3.10.2 Member checking

Member checking involves taking selected transcripts or themes back to participants, and give them space to provide feedback on their accuracy (Bloor & Wood, 2006). However, Maxwell (2009, p. 244) argued that "participants' feedback is no more inherently valid than their interview responses"; he asserted both should be taken as evidence regarding the validity of an account (ibid.). Presentation of mirror data to participants in BCCLW in Chapita and Waziloya Makwakwa case studies was the most plausible way to solicit participant feedback about the data initially. This is because I carefully selected the mirror data and it comprised meaningful data for the research. However, I did not do member checks with participants from Chilije case study due to financial constraints, which was the same reason why I did not facilitate expansive learning. However, I verified the findings with two Field Facilitators responsible for implementing ICS project in the area and their comments on the end-user and stove production members accounts were consistent. The second phase of member checks took place after carrying out BCCLW. Before I left the field, I presented a summary of what we had discussed in both Chapita and Waziloya Makwakwa case studies and I solicited feedback from participants. The third phase of member checks occurred at the start and then at the end of follow-up workshops. After carefully going through data, I presented it to participants to make comments. During this time, for example, in Waziloya Makwakwa case study we found out that the experimentation on different aspects of the ICS was unclear (see Chapter 7, Section 7.3.6.1). We deliberated on this and the comments were fruitful and helped to shape the way forward for the consolidation session. At the end of follow-up workshops, I summarised all the discussions and requested members make comments. Apart from the three stages of member checks, I did member checks with the Director of DoEA in an interview on the contextual profile data before proceeding to interviewing him.

3.10.3 Use of thick descriptions and prolonged involvement with participants

Use of thick descriptions may help to transport readers to the setting and give the discussion an element of shared experiences (Creswell, 2003, p. 196). Maxwell (2009) also argued for "rich" data that are detailed and varied enough that they provide a full and revealing picture of what is going on (p. 244). He elaborated that when interviews are used to collect data, the researcher needs to include verbatim transcripts of the interviews, not only notes on what the researcher felt was significant (ibid.). To obtain rich data, one needs a long period of involvement with participants and should carry out intensive interviews (Maxwell, 2009). Pictures, videotaping and descriptive notes are necessary if data is captured through observation (ibid). As indicated above, methodological triangulation allowed me to obtain varied

rich data from different settings and from different activity systems. The different settings included the study areas, the households and its surrounding areas and the kitchen; the BCCLW was also another setting that added to the collection of rich and varied data because of its multi-voiced nature, typical of third generation CHAT. I spent a considerable amount of time with participants. I started observing what was going on, and interviewing people during contextual profiling, during the exploratory phase, then the expansive learning phase and during follow-up workshops and follow-up dialogues. I also made several telephone communications in between with research participants, I held meetings with Project Officers and Project Managers and communicated through emails. Briefly, the interventionists and intensive research approaches used in this study allowed me to engage with the participants and the research settings for longer.

Further, to allow readers to reach their own interpretations (Bloor & Wood, 2006), I have used thick descriptions and verbatim excerpts from research participants' responses in reporting findings. I have also included pictures and I have appended video clips and audio records wherever necessary to maximise validity of data.

3.10.4 Reflexivity

Reflexivity implies that the researcher reflects continuously on how their actions, values, and perceptions can affect the research setting, collection of data and analysis (Lambert, Jomeen, & McSherry, 2010 and Creswell, 2003). Hammersley and Atkinson (as cited in Cohen et al., 2011) explained that reflexivity recognises that researchers are an inescapable part of the social world that they are researching (p. 225). This social world has already been interpreted by the actors and this undermines the notion of objective reality (Cohen et al., 2011, p. 225). In qualitative research, researchers bring their personal biographies, values, biases, interests and worldviews, which they use as lenses to look into and interpret the world they are researching (Cohen et al., 2011; Creswell, 2003). Reflexivity suggests that researchers should acknowledge and disclose their own selves in the research, seeking to understand their part in, or influence on the research (Cohen et al., 2011, p. 225). In order to combat reactivity through reflexivity, researchers need to monitor closely and continually their own interactions with participants, their own reaction, roles, biases and any other matters that might affect the research (McCormick & James, in Cohen et al., 2011, p. 225). One way for ensuring reflexivity is also to employ multiple strategies of validity (Creswell, 2003), which I have discussed above.

Reflexivity in my role as formative interventionist researcher

In this study, my role as formative interventionist researcher aimed at provoking and sustaining an expansive transformation process led and owned by participants (Engeström, 2011, p. 606) during

BCCLWs. This required striking a balance between my role and the participants' role. I continuously reflected on how I was making my contribution (see Section 3.5.1 on the roles of formative interventionist researcher) in ways that enabled participants to own the transformation process. I also continuously reflected on my role before BCCLW, during data collection. In the sections below, I elaborate how I reflected on my role and other matters that could have influence on the research.

My role as a formative interventionist researcher in data collection: My role as a formative interventionist started with data collection in the first phase of the study. Since my study focused on contradictions within and between activity systems, this may have influenced the type of data I wanted to generate. In order to combat this, I used methodological triangulation as indicated earlier. I also allowed a research participant to take field notes, to increase objectivity. After each day of data collection, I would reflect on the day with the two research assistants. I recorded the reflections in a reflexive journal (Cohen & Crabtree, 2006). I used these reflections in planning the next visit and constantly reflected on these while in the field. One of the reflections was on how we spent a long time videotaping the interviews and the surrounding observations. We realised that we could not sustain this due to power available in our recording instruments. After a few hours, we abandoned the video recording and stuck to the still pictures and audio recorders for data collection.

Another issue was the use of two languages during interviews (Chitumbuka and Chichewa) in the Waziloya Makwakwa case study. I spoke in Chichewa and research participants responded in Chitumbuka (see Section 3.9.1 for my proficiency levels). During individual interviews, the CADECOM project chair was available to offer interpretation where necessary. The presence of the chairperson may have reduced research participants' freedom to express themselves, which could have had implications on their responses.

My role as a formative interventionist researcher in facilitating BCCLWs: In facilitation of BCCLW, I realised that the sessions were dragging at the beginning in both case studies. This may be in part due to the nature of the groups I had. Some people had no basic education and some people had tertiary education. I realised that some participants had difficulties in following the discussions. This was also due to participants' expectations. In the Chapita case study, participants revealed to me that they expected that I would play a teacher and they would play students who were expected to listen, take notes, and answer questions. They expected me to know the answers and provide them with the knowledge. This, as already discussed, is contrary to BCCLW, where there is no teacher and no student. Another issue which dragged the sessions in Chapita case study was that the mirror data presented, which reflected the problems within and between activity systems, aroused a lot of tensions and emotions. I had to allow

participants to deliberate, at the same time it consumed a lot of time. In Waziloya Makwakwa case study, the first problem was language. As during the exploratory phase, two languages were involved; I spoke in Chichewa, and participants spoke to me in Chitumbuka. At some points, I realised that participants could not follow the discussions. In some sessions, the Field Facilitator had to interpret to the participants what I was saying. Unfortunately, there were times his interpretation was not correct and I would indicate that to him and tried to explain in Chitumbuka, but since my production level was not good, it took a long time. There were times that the Field Facilitator did not like my objection to his interpretation. This resulted in tensions in some sessions.

A second issue in Waziloya Makwakwa case study was that participants were copying notes more than listening and participating in the discussions. Despite several attempts to stop them, they would not stop. As a result, I banned note taking for the rest of the sessions, except when I gave them a task, and they had to copy instructions. Some participants complained that they learn better through note-taking, but I maintained my position. These issues had implications on time management. Already we were working on a tight schedule due to financial constraints because my research allocation was only enough for conventional data collection and not interventionist research. Sometimes participants showed signs of fatigue. This could have reduced their levels of concentration. In both case studies, I was requested to stick to our agreed schedules for breaks and stopping. I tried to adhere to this; however, in several instances, we finished late.

Another issue in Waziloya Makwakwa case study was that I had a very pre-emptive Field Facilitator. He wanted us to skip some planned tasks and insisted that some tasks could be completed at home by the participants. I insisted that all the tasks needed my presence, except those I planned for them to take home. At some point, he resorted to remaining quiet throughout the session. At the end of the day, I held a discussion with him and explained that purpose of the sessions was to deliberate collectively in a particular space.

In the Chapita case study, another issue that might have had an influence on the research was the availability of the implementers during BCCLW sessions. The representative for the implementer activity system attended the planning meeting and then consolidation session. I tried to remind them on several occasions, and at one time, I planned a meeting with them to give them an update on the progress of the workshops. Participants felt their absence because several issues needed their input. Similarly, policy representatives were not available. I tried to contact them through telephone and emails, but there was no response.

3.11 Conclusion

This chapter has discussed the theoretical and methodological frameworks employed in the study. The first part of the chapter discussed CHAT as the epistemological theory followed by CR. I worked with CHAT and CR because they resonated with the agenda of the study that focused on learning as an emancipatory process and transformation of human practices through evoking agency and reflexivity of those involved. The theory of Expansive Learning/ DWR was discussed in the second part. The second part of the chapter concentrated on the research design and research approach employed in the study, methods, ethical and validity issues. It focused on how I designed and implemented the study to be able to answer the research questions. The process, which started from contextual profile in 2014, continued to the end in March 2017. The chapter has also discussed some of the challenges encountered during the first and second phases of the study, and in some cases, I have discussed how I navigated the situations.

CHAPTER 4: PROFILE OF COOK STOVE UPTAKE AND UTILIZATION

4.1 Introduction

This chapter answers question 1: What is the profile of uptake and utilisation of Improved Cook Stoves (ICS), what factors promote and hinder its uptake and utilisation?

This chapter provides the profile of uptake and utilisation of cook stoves and provides a range of factors that promote as well as hinder both uptake and utilisation of ICSs in the three case studies. I have also briefly discussed the profile of uptake and use of ICS at national level. As pointed out earlier in Chapter 1, the focus of the study was to understand why sustained utilisation of ICSs is problematic, and why fuel stacking is common among end-users who own an ICS and TSF. However, this could be practical by documenting the profile of uptake before understanding issues pertaining to use. For instance, as I will discuss in the chapter, the problem in Waziloya Makwakwa case study, turned out to be uptake, which had implications for use of the fixed ICS.

The profile of uptake and utilisation of ICSs was captured using observation, augmented with pictures and citations from interview data where data was available to support observation data (see Chapter 3, section 3.7.3). Lambe and Atteridge (2012) and Atteridge et al. (2013), in studies carried out in India and Zambia, observed that what respondents told them about their cooking practices often differed greatly from what they actually did. Hence, observation was the main method used for documenting uptake and use as discussed in Chapter 3.

This chapter provides a foundation for Chapters 5 and 6 that build on the factors that hinder both uptake and utilisation of cook stoves discussed here. Some factors shed some light on the nature of interaction between actors working with ICSs, which are expounded in Chapter 5 as existing learning interactions and tenuous interactions among activity systems. Some factors helped me to surface problematic aspects of the ICS practice. This sharpened my understanding and identification of contradictions existing within the uptake and use of ICS, which are discussed in Chapter 6.

Participants identified many factors that promote as well as hinder uptake and utilisation of ICSs. In several instances, participants gave more than one factor as a reason why they do not have a stove and/ or why they abandoned the ICS, or why they practice fuel stacking. For example, one participant gave the following as reasons for not using the stove: lack of encouragement from implementers, cracking of

the stove on the upper door and difficult to remake fire when it is out (see section 4.3.1.4 *TSF & ICS user VN*). Thus, it was difficult to construct an understanding that could explain unsustained use of ICSs based on the factors alone. Consequently, in Chapter 6, the factors are delineated into contradictions identified within the uptake and utilisation of cook stoves that could help explain unsustained use of the stove in a more nuanced manner.

The chapter uses mainly inductive analysis, as themes were identified from observations and interview data to explain the profile of ICS uptake and utilisation, I also drew out similarities from the themes in order to provide a cross case analysis (Danermark et al., 2002). The cross case analysis has in part used abductive analysis to provide a general sense and meaning of the factors promoting and hindering uptake and utilisation of ICS. The problematic situations presented in this chapter laid the initial steps in the identification of contradictions discussed in Chapter 6. Some factors constituted contradictions. However, some did not. In instances where a factor constitutes a contradiction, a cross reference is used, where necessary, when providing evidence from citations to avoid repetition.

4.2 Profile of Uptake and Utilisation of cook stoves

4.2.1 Chapita Village Case Study
As indicated in Chapter 3, I observed 26 households and their kitchens and took pictures. I also interviewed nine end-users from the three end-user activity systems (see section 4.2.1.1 for the descriptions) (also see Appendix 10) drawn from the 26 households observed, one ICS production group, one promoter, one trainer and one Field Facilitator.

4.2.1.1 Cook Stove uptake
Of the 26 households, only two households had an ICS. I labelled this group as *ICS users activity system.* However, of the two, one household had Chitetezo Mbaula, while the other one had a fixed stove, which was not disseminated in the study area. The participant constructed the stove because she had no money to purchase the Chitetezo Mbaula (see Section 4.3.1.2 *ICS user SM* and Chapter 6, Section 6.3.2.9). I decided to classify the fixed stove as ICS since it had similar principles to an ICS (see Chapter 1, section 1.4.3). Eleven households had a TSF only and I labelled the group as *TSF user activity system.* Thirteen households had both TSF and an ICS, so I categorised them as *TSF & ICS user activity system.* (See Chapter 5, section 5.2.1.6 for detailed descriptions of the three end-user activity systems.)

In summary, of the 26 households, 24 had TSF (this included those who had both ICS & TSF and those with TSF only) and 15 households had an ICS (this included those who had both TSF & ICS and those with ICS only). (See Table 4.1 below for a summary).

Types of stoves available and number of cooking places: I identified three types of cook stoves in the study site, including ICS, TSF (traditional cook stove) and charcoal stove. I found a charcoal stove in two households of the 15 households with an ICS.

All the households that had an ICS owned only one ICS. I also observed that some households had more than one TSF cooking place (see Photo 4.1). Of the 24 households that had TSF, six had two to three TSF cooking places used at the same time (see Photo 4.1). Of the six, three were *TSF users* and the rest were *TSF & ICS users.* The rest (18 households) had one TSF cooking place. This means that 16 households of the 26 had more than one cooking place, while 10 households had only one cooking place. This data therefore shows that most households use more than one cooking place, either an ICS in conjunction with TSF, or two to three TSFs, or a combination of TSF, ICS and charcoal stove. This scenario relates to the search for convenience, especially the need to speed up cooking in order to save cooking time (see Section 4.3.1.4). It is worth noting that there was no TSF cooking place identified at the *ICS users'* households.

Photo 4.1: Cooking with TSFs (left), and two TSF places at a household (right) (Chisoni, August 2014)

Table 4.1 below provides a summary of types of stoves identified in the 26 households and the corresponding number of households.

Table 4.1: Profile of cook stove uptake in Chapita Village Case study

Type of cook stove available	Number of households
ICS	2
TSF	11
TSF & ICS	13
TSF, ICS & charcoal stove	2

Source: Jalasi, 2018

4.2.1.2 Cook Stove utilisation

In order to record the profile of utilisation, I observed and recorded the following: spotting an ICS in use, type of stove used on the days of observation, signs that ICS stove had been used before, signs that the TSF had been used before, size of the pot being used on the ICS, and ICS condition (whether broken, cracked or intact). I also checked whether there were any sings of tampering with TSF in order to conceal

information. In addition, I recorded the type of fuel used for cooking. Since observation was carried out in few days, I used interviews to augment observation data. This helped me to get information on what participants do every day. Specifically, I needed to solicit information from participants on whether they use the TSF or ICS and which one of the two they used every day, and /or sparingly, as well as to discover reasons why sustained utilisation is problematic.

In order to find out the type of stove used on the day of observation, we checked the availability of heat, and fresh ashes in the stoves. Of the 26 households, 18 households used a TSF for cooking that day, four households had used an ICS (see Photo 4.2 for examples), one household used both TSF and ICS, one household used a charcoal stove and two households had not cooked. Additionally, I spotted only three stoves in use. (See Appendix 12, Chapita Village case study.)

Photo 4.2: Cooking with ICS- fixed ICS (left) and Chitetezo Mbaula (right) (Chisoni, May 2015)
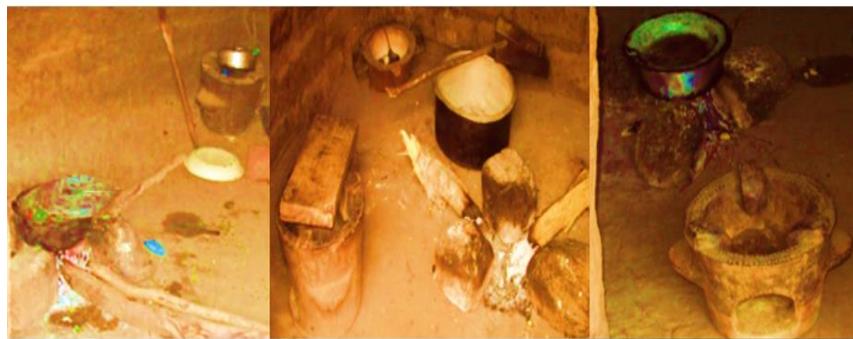
On the other hand, TSFs were showing signs of use every day in 24 households, yet ICS were showing signs of use every day in two households only (the *ICS users*). Further, I found that in 14 households, ICSs showed signs that they had been used before. (See Photos 4.3 and 4.4). Some stoves were showing that they had been used probably once, they were cleaned and kept safe (see Photos 4.3 and 4.4 below), some had been used few times and abandoned, while some were showing that they had been used several times before they were abandoned (see Photo 4.4).

Most households that I found cooking used firewood, while some used maize cobs. Despite finding animal dung in six households, it appeared this was not used for cooking. Pot sizes found on ICSs were small and medium. However, during BCCLWs participants explained that they are able to use big pots or 20 litre pails mainly for boiling water and cooking other food stuffs on the ICS, except *nsima* which is difficult to cook on the ICS (see Sections 4.3.1.4, 4.3.3.3 and Chapter 6, Section 6.3.1.4).

In terms of ICS condition, I found that ten ICSs were cracked but were still in working condition, four stoves were broken and one (fixed type stove) was in excellent condition. All the cracks observed occurred on the upper door of the stove, and this prompted further investigation to understand why. The

crack turned out to be among the factors hindering utilisation (see Sections 4.3.1.4 & 4.3.3.4) and constituted one of the contradictions (see Chapter 6, Section 6.3.2.1). It is also worth noting that TSF cooking places were not tampered with to conceal any evidence, especially in the TSF & ICS users' households.

In summary, the data presented indicates that sustained use of ICS is problematic. Most households who own an ICS use it sparingly, or it is abandoned; instead they use a TSF every day. The findings are augmented with evidence provided in Sections 4.2.1.3 and 4.3.1.4 from interviews.

Photo 4.3: Cooking with TSF while an ICS lies idle (Chisoni, May 2015)

Photo 4.4: Used and abandoned ICS (Chisoni, May 2015)

4.2.1.3 Frequency of cooking on Improved Cook Stove and Three Stone Fire

In order to augment observation data, I asked participants who owned both a TSF and an ICS to indicate how often they use the ICSs, as well as the TSF. A few examples of their responses are provided below:

> **Researcher:** *How many times would you say you cook on the ICS in a week, six times, five times or three times?*
>
> **TSF & ICS user II:** *Maybe two or three.* (Interview # BK3)
>
> **Researcher:** *How about three stone fire?*
>
> **TSF & ICS user II:** *For three stone fires, we really use them*. (Interview # BK3)
>
> **Researcher:** *Does that mean every day?*
>
> **TSF & ICS user II:** *Yes.* (Interview # BK3)

Another end-user's response below indicates that she abandoned the ICS after using it in the first days after they bought it:

> **TSF & ICS user VN:** *That would be difficult to count. (Laughs). Because you know the way people cook in the village, we may cook relish, uh! maybe I can say we used to cook with it (ICS) during the first days (when we bought it) we used to cook with it, maybe I can estimate up to four times a week.* (Interview # BK4)

Another end-user indicated that she turns to the TSF when she does not have small pieces of firewood that can fit in the ICS:

> **TSF & ICS user MB:** *I use it (ICS) every day as long as I have all the requirements, but with the problem (lack of small pieces of firewood), I have today I am cooking there (on TSF).* (Interview # BK8)

Further, another end-user indicated that both the TSF and ICS are used every day at her house because some members of the household like to cook on the TSF while she likes the ICS:

> **TSF & ICS user ZJ:** *We use the ICS every day.* (Interview # BK1).
>
> **Researcher:** *So how about the TSF?*
>
> **TSF & ICS user ZJ:** *For that, grandmother likes to use it.* (Interview # BK1).
>
> **Researcher:** *So does that mean that every day you also cook with TSF?*
>
> **TSF & ICS user ZJ:** *Yes, the others use it every day.* (Interview # BK1).

The citations above from *TSF & ICS user MB* and *TSF & ICS user ZJ* indicate that some factors hinder sustained use of the ICS. This prompted me to analyse the data further to understand factors that hinder and promote ICS utilisation as presented in section 4.3.

Evidence from the citations above show that the TSF is used every day in most households, either in conjunction with ICS or exclusively. This data supports the observation data presented in Section 4.2.1.2 above. In Section 4.3, I further provide support for observation data through providing factors that promote and hinder both ICS uptake and use. However, my main interest was on factors that hinder utilisation (see section 4.3.1.4) as this provided explanation to why the profile of utilisation was low.

4.2.2 Waziloya Makwakwa Village Case Study

In Waziloya Makwakwa Village case study, I observed 21 households and their kitchens and took pictures (see Chapter 3, Section 3.7.3 and Appendix 11). On the first day, I only observed, and on the second day, I combined interviews with observations. I interviewed six women from the 21 households I had observed on the previous day. In addition, I interviewed three representatives of the ICS construction group, one Project Officer, and one Field Facilitator (see Appendix 10).

4.2.2.1 Cook stove uptake

Of the 21 households, six households had ICS only. I labelled this group as *ICS user activity system.* Fourteen households had TSFs, I categorised them as *TSF user activity system,* and one household had both ICS and TSF and I labelled them as *TSF & ICS user activity system*. It was rare to find participants with both ICS and TSF in this case study. However, an explanation is provided for owning and /or using both TSF and ICS (see section 4.2.2.3, citation from *TSF & ICS user MP*). Moreover, it appears that most end-users, who had an ICS, used it exclusively in this case study unlike in Chapita village and Chilije village case studies. In summary, of the 21 households, 14 had TSF only, six households had an ICS only and one household had both TSF & ICS.

Types of stoves available and number of cooking places: Two types of cook stoves were identified in the study site, including ICS and TSF. All seven households that had an ICS owned only one ICS. I also observed that all the households with TSFs had one TSF cooking place. This was also the case in Chilije village case study unlike in Chapita village case study. Table 4.2 provides a summary of the types of cook stoves available in the participating households and the corresponding numbers of households. (See also Appendix 12, Waziloya Makwakwa case study).

Table 4.2: Profile of cook stove uptake in Waziloya Makwakwa Village Case study

Type of cook stove available	Number of households
ICS	6
TSF	14
TSF & ICS	1

Source: Jalasi, 2018

4.2.2.2 Cook stove utilisation

In order to record profile of utilisation in Waziloya Makwakwa, I observed and recorded the same things as presented in section 4.2.1.2 above. Similarly, I used interviews to augment observation data. (This also applies for Chilije case study.)

Of the 21 households, 13 households used a TSF for cooking that day, five households had used an ICS, one household used both TSF and ICS, and two households had not yet cooked. In addition, I spotted five stoves in use.

Further, TSFs were showing signs of use every day in 15 households (see Photo 4.6) (this included the house that used both ICS and TSF), yet ICS were showing signs of use every day in all the six households that had an ICS (see Photo 4.5 below).

Photo 4.5: ICS in use (left) and ICS showing signs of use every day (right) (Chisoni, June 2015)

Photo 4.6: TSF in use (left) and TSF showing signs of use every day (right) (Chisoni, June 2015)

Most households that I found cooking, used firewood, however some maize cobs were found in two households and the participants indicated that they sometimes used them for cooking. The size of pots used on the ICS ranged from small to big.

In terms of ICS condition, I found that three were cracked on the upper door but were still in working condition, while the other three were in excellent condition. Participants explained that the crack was due to failure to care for the stove, especially due to the use of bigger logs of firewood. I did not find any signs of tampering with cooking places to conceal any evidence, in the households using TSFs as well as both TSF and ICS.

In summary, the data presented indicates that there is sustained use of ICS in the Waziloya Makwakwa case study, with one household combining TSF and ICS. The reason for using ICS in combination with TSF is presented in Sections 4.2.2.3 and 4.3.2.3 below. Most households who own an ICS use it exclusively, since the stove saves cooking time mainly because it has three cooking places (see Section 4.3.2). Further, I did not find an ICS abandoned. These findings are augmented with evidence provided in Sections 4.2.2.3 and 4.3.2.3 from interview data. While in Chapita village, case study end-users are in search for convenience, in Waziloya Makwakwa the ICS provides convenience in terms of cooking time.

4.2.2.3 Frequency of cooking on Improved Cook Stove and Three Stone Fire

In order to augment observation data, I asked some participants who owned an ICS (including the one who had both an ICS and TSF) to indicate how often they used the ICSs and/or TSF:

> **Researcher:** *Since you started cooking on the stove, have you also cooked on three stone fire?*

> **ICS user RS:** *Yes, because the kitchen was leaking right where the stove (ICS) was.* (Interview # MZ6)

> **TSF & ICS user MP:** *We only cook on the stove (ICS), even though sometimes we cook on the three stone fire, but it is not every day. It happens when the three places (of the ICS) are filled up.* (Interview # MZ 5)

> **ICS user LJ:** *No, I do not even want them (the three stones).* (Interview # MZ1)

In summary, evidence from the citations above shows that the ICS is used frequently and/ or every day in most households that own an ICS. However, some factors occasionally hinder participants from using the ICS. I have explained the factors in detail in Section 4.3.2.4 below. The data supports the observation data presented in Section 4.2.2.2 above. I further provide support for observation data through providing factors that promote and hinder both ICS uptake and use in Section 4.3.2. In this case study, my main interest was on factors that hinder uptake, as well as those that promote utilisation. Since uptake was problematic, I needed to find explanations. At the same time, I was interested in finding out why utilisation was good in this case study as this could provide learning insights for cook stove practice in the other case studies as well as at the national level.

4.2.3 Chilije Village Case Study

In Chilije Village case study, I observed 24 households and interviewed two Field Facilitators, one stove production group and four end-users as explained in detail in Chapter 3, Section 3.7.3 and Appendices 10 and 11).

4.2.3.1 Cook stove uptake

Of the 24 households I observed, 14 households had both TSF and ICS, eight households had a TSF only and two households had ICS only. I labelled the groups in the same way as in Chapita village and Waziloya Makwakwa village case studies (see Sections 4.2.1.1 and 4.2.2.1).

In summary, of the 24 households, 22 had TSF (this includes those who had both ICS & TSF and those with TSF only) and 16 households had an ICS (this includes those who had both TSF & ICS and those with ICS only).

Types of stoves available and number of cooking places: I identified two types of cook stoves in the study site, including ICS and TSF. I also found that eight households had more than two ICSs. However, most of these participants were in the production group. They distributed the stoves and kept them safe

at their households because they were experiencing storage problems due to marketing problems (see Chapter 5, Section 5.2.3.2, Photo 5.1 and Chapter 6, Section 6.5.2.3). The rest of the households owned only one ICS. In this case study, I observed that all households that had a TSF had only one cooking place.

Table 4.3 below provides a summary of the types of cook stoves available in the participating households and their corresponding numbers. (See also Appendix 12, Chilije Village case study.)

Table 4.3: Profile of cook stove uptake in Chilije Village case study

Type of cook stove available	Number of households
ICS	2
TSF	8
TSF & ICS	14

Source: Jalasi, 2018

4.2.3.2 Cook stove utilisation

Of the 24 households observed, only two households had used an ICS for cooking that day (see Photo 4.7), one household used both TSF and ICS, and 21 households used a TSF only (see Photo 4.8). However, I only spotted one stove in use (See Photo 4.7).

Photo 4.7: ICSs spotted in use (Chisoni, May 2015)

In the above photo, one stove was in use, while the household of the other one (right) had just finished cooking.

Photo 4.8: TSF spotted in use (Chisoni, May 2015)

Photo 4.8 above shows some examples of TSF spotted in use with one household using crop residues for fuel.

Further, TSFs were showing signs of use every day in 22 households (see Photo 4.9), yet ICS were showing signs of use every day in three households only. I also found out that in 16 households ICSs showed signs that they had been used before (not on that particular day) (See Photo 4.10). Some stoves were showing that they had been used probably once, they were cleaned and kept, and some had been used few times and abandoned, while some were showing that they had been used several times before they were abandoned (see Photo 4.11).

Photo 4.9: TSF showing signs of use every day (Chisoni, May 2015)

Photo 4.10 ICSs showing signs of use (Chisoni, May 2015)

Photo 4.11 Used and abandoned ICSs (Chisoni, May 2015)

Most households that I found cooking used firewood. However, I found crop residues at two households who indicated that they use it for cooking (see Photo 4.8). Others reported that they use trash as fuel for cooking on the ICS (see section 4.3). In terms of pot size, I found a medium pot on the ICS. It is worth noting that the ICS disseminated in the case study is similar to that of Chapita village case study, hence the ICS can accommodate the same size pots as explained in Section 4.2.1.2.

In terms of ICS condition, I checked only the stoves that had been used before since some of them were broken due to lack of storage space. I found that 12 ICSs were cracked but were still in working condition, one stove was broken and five were in excellent condition. It is also worth noting that no TSF cooking places were tampered with to conceal any evidence.

In summary, the data presented indicates that sustained use of ICS is problematic, similar to the Chapita village case study. Most households who own an ICS use it sparingly, usually in combination with TSF or it is abandoned; instead they use a TSF every day. These findings are augmented with evidence provided in Sections 4.2.3.3 and 4.3.3.4 from interview data.

4.2.3.3 Frequency of cooking on Improved Cook Stove and Three Stone Fire
In order to augment observation data presented above, I asked the *TSF & ICS users* to indicate how often they used the ICSs. A few examples are given below:

> **Researcher:** *How many times a week do you use the stove, let's say every day, five times, three times or once a week?*
>
> **TSF & ICS user GW:** *I have not lit fire in this (ICS).* (Interview # DZ1)
>
> **TSF & ICS user YT:** *I should not lie I do not use it (the ICS).* (Interview # DZ4)

Evidence from the citations above shows that the ICS is rarely used or abandoned. However, during group interviews with production group members, they expressed that they use ICS in combination with TSF as an alternative cooking device in order to speed up cooking (see Section 4.3.3.3). This explains why ICS in some households showed signs that they have been used before as discussed in section 4.2.1.2. Hence, this interview data supports the observation data presented in section 4.2.3.2. In Section 4.3, I further provide support for observation data through providing factors that promote and hinder both ICS uptake and use. However, my main interest in this case study was on factors that hinder utilisation (see Section 4.3.1.4) as this provided explanation to why the profile of utilisation was low which was a similar case with Chapita Village.

4.3 Factors promoting and hindering Improved Cook Stove uptake and utilisation

In order to augment further observation data, I analysed the data in terms of factors that promote and hinder both stove uptake and utilisation. This is because some participants did not feel free to indicate the frequency of use of the ICS versus TSF. However, as the interviews went on, they were able to explain reasons why they do not use the ICS frequently, or switch between ICS and TSF, or abandon the ICS. I decided to solicit the information from all participants interviewed in all the activity systems in all

the three case studies, instead of relying on those who owned ICSs in order to enrich my understanding from multiple perspectives. Also, because of the interaction existing between the activity systems, it helped me to tap into their everyday conversations and what was happening in the past around ICS in the absence of the researcher, in order to understand the practice better.

4.3.1 Chapita Village Case Study

4.3.1.1 Factors promoting ICS uptake

Firewood saving: Participants identified firewood saving as a factor promoting both uptake and utilisation of stoves (see section 4.3.1.3). In the quotes below, participants expressed that they were encouraged to purchase the ICS (before they saw it) because it saves firewood.

> *TSF & ICS user VN: […] when I arrived here, my mother told me that there are stoves (ICS) in the village that with only three pieces of firewood you can cook properly. So, I got interested and I told my mother that she also needs to have that stove […] and I took money and paid in advance.* (Interview # BK4)

> *TSF & ICS user II: I bought the stove (ICS) because it is helpful because it does not consume a lot of firewood. […] you know sometimes firewood is a problem, so that stove does not consume a lot of firewood compared to three stone fire.* (Interview # BK3)

It is important to note that the only factor mentioned as promoting ICS uptake is firewood saving. This is because firewood is scarce in Chapita village as discussed earlier in Chapter 1.

4.3.1.2 Factors hindering ICS uptake

On the contrary, participants indicated a number of factors that hinder ICS uptake. It is interesting to note that some end-users indicated more than one factor as a reason that hindered them (see for example, *TSF user KG* and *TSF user RA*) or hindered other people to purchase an ICS:

Financial status: Some participants identified financial status as a factor that hinders some people from purchasing the ICS in the following citations:

> *TSF user RA: I did not buy (the ICS) because of financial problems. That time I had no money.* (Interview # BK9)

> *ICS user SM: It's because money is difficult to find these days. If you have no job, you just wake up and stay home like the way I am, you have nothing to do (no job), where would you find MK300? You cannot find it, unless you go do some piecework in the gardens, or if you have a small business then you can manage to buy the stove (ICS).* (Interview # BK2)

> *Field Facilitator LM: […] some people say it's expensive because it's now at MK500. People say It's expensive to get MK500 and buy that one (ICS) as opposed to cooking on three stone fire.* (Interview # BK11)

> *Stove producer 2: For some people it is difficult to use the little money they have to purchase a stove because these days the stove price is high it is at MK500. So the way things are these days*

it is difficult to get a MK500 to purchase a stove. People would prefer to use the money for the maize mill. (Interview # BK10). (See also Chapter 6, Section 6.3.2.9 for more evidence)

Scarcity of stoves: One participant expressed that she had no stove because the production group was no longer producing stoves and stoves were not available. At first, she indicated that she had no money when the stoves were available (see 4.3.1.2.). When I asked why she did not have a stove at the time I conducted interviews, she gave the following response:

> *TSF user RA: Now they have stopped producing.* (Interview # BK9).

Despite that only one participant mentioned scarcity of stoves as a factor hindering stove uptake, it became one of the major issues deliberated during BCCLW because I identified it as constituting one of the contradictions with wider implications for the production and ICS practice. (See Chapter 6, Section 6.3.2.5, Chapter 7, Sections 7.2.2, 7.2.3 and Chapter 8, Section 8.2.1.2.)

Mishandling of incentives: Pigeon peas are provided to potential stove users as an incentive to promote uptake; however the incentive is exploited which hinders ICS uptake. (See Chapter 6, Section 6.3.3.3 for evidence, citations from *TSF user KG*, for example and for further details.)

Cracking of ICS on the upper door: Some participants identified the crack on the upper door of ICS as a factor hindering uptake, as well as utilisation, as indicated earlier. For evidence on how the factor hinders uptake and utilisation see Chapter 6, Section 6.3.2.1.

Physical appearance of stove: The fact that the ICS is made of local materials, especially that it is clay soil, discourages some end-users from purchasing the stove. This factor was also identified in Waziloya Makwakwa case study.

> *Field Facilitator LM: People take that stove as muddy stove, some people say it can easily break and lose their money […] they want the one that is steel. Yea but […] but I know some (perceptions) are caused by the literacy levels […].* (Interview # BK11)

Laggards: One participant indicated that some people do not have stoves because they are laggards. Laggards are a category of adopters who are the last to adopt an innovation (Rogers, 2003) "They have a traditional view and they are more sceptical about innovations and change agents" (ibid. as cited in Sahin, 2006, p.20). Laggards usually lack awareness-knowledge of innovations, and they first want to make sure that an innovation works before they adopt; they wait to see whether other members of the social system successfully adopt the innovation (Sahin, 2006, p. 20). The citation below illustrates this:

> *Stove producer 2: You see we are born different. Some take time to respond, by the time they do, most people have already made a lot of progress, they take time to understand or think […].They want to wait and see whether what their friends are doing is important or not. You know people from the village they think slowly. It takes time for them to realize what is going on and to participate. These are the people you see have no stoves.* (Interview # BK10).

It is interesting to note that laggards were also identified in Waziloya Makwakwa case study as a factor hindering ICS uptake.

4.3.1.3 Factors promoting utilisation

Few factors were identified as factors promoting ICS utilisation, as presented below:

Firewood saving: As indicated earlier, firewood saving was a factor promoting both uptake and utilisation in this case study. The quotations below provide evidence:

> ***TSF & ICS user ZJ:*** *What make us cook on the cook stove is that it helps us… in fact I should just say it saves firewood, it is different from three stone fire.* (Interview # BK1)

> ***TSF & ICS user FK:*** *I realised that you do not consume a lot of firewood (on the ICS) compared to the three stone fire.* (Interview # BK5)

> ***TSF & ICS user VN:*** *What made us to use this stove is that it saves firewood […] because the door does not allow a lot of firewood. So when you put three pieces of firewood you just push the same ones inside until when those three are consumed then you can put some three pieces again.* (Interview # BK4)

> ***ICS user FJ:*** *We use the stove because it saves firewood. We can cook nsima, after that we put water and the water can become hot because it keeps heat. […] the stove saves firewood that is why I decided to remove the three stone fire completely.* (Interview # BK7)

Rainy season: Rainy season was identified as one of the factors promoting ICS uptake and use. In the citation below, the promoter indicated that end-users purchase and use the ICS frequently during rainy season; this is because the stove is portable and it provides convenience since it can be moved to a sheltered place even inside a house.

> ***Stove promoter SB****: […] you remember I said most people do not like using the stove during this season, but during rainy season. Also during rainy season, you sell more stoves than this season.* (Interview # BK12)

4.3.1.4 Factors hindering utilisation of ICS

Lack of sensitisation and encouragement from stove implementers: Some participants indicated that lack of sensitisation and encouragement from ICS project implementers may contribute to hindering utilisation, because end-users may not be encouraged to use the new technology as evidenced in the citations below:

> ***TSF & ICS user ZJ:*** *It can discourage you. If they (implementers) can be visiting, it means they would be encouraging the end-user to have interest to use the stove. You know, since we were born we have been using three stone fire, and if there is no any encouragement, we will continue what we have been doing – cooking on the three stone fire.* (Interview # BK1)

> **TSF & ICS user VN:** *If they (implementers) were visiting more, it would encourage you to use the cook stove […] but if they are not visiting the community then you may just use the stove (ICS) for a short time and then stop.* (Interview # BK4)

> **Field Facilitator LM:** *[…] if there are no messages that have gone to that end-user about the importance of the stove, they cannot use that one (ICS).* (Interview # BK11)

Similarly, participants in Chilije village case study identified this factor as hindering ICS utilisation (see Section 4.3.3.4).

Old age: Participants identified old age as a factor hindering stove use. One reason is that the stove weighs approximately 10 kilograms; hence, elderly people may find it heavy to carry from one place to another. The quotes below provide evidence:

> **TSF & ICS user ZJ:** *Grandmother likes to cook on the three stone fire, […] may be she is used to the three stone fire [...] the only person who uses the three stone fire at this household is grandmother.* (Interview # BK1)

> **TSF & ICS user VN:** *The problem is that for elderly, it may be difficult to carry the stove to change places. For example, my mother cannot carry that stove; it means that if I am not around, she will have to stay where I have left it. When the sun reaches that place, she cannot move […] if rain comes suddenly, she cannot carry the stove into the kitchen because it is heavy.* (Interview # BK4)

> **TSF & ICS user VN2[26]:** *I fail to carry it, so I tell her that when you are not around I will be cooking on the three stone fire.* (Interview # BK4)

Cooking many dishes: One participant also explained that she uses the TSF in combination with the ICS because they have many dishes to cook. In this case, the stove provides an alternative cooking device and satisfies the search for convenience. When I asked why she is not accustomed to cooking on the ICS, she responded:

> **TSF & ICS user ZJ2:** *We have many dishes to cook.* (Interview # BK1).

Difficult to cook *nsima*: Some participants expressed that it was difficult to cook, especially *nsima* with a pot without a handle, especially for large families, as evidenced from the quotes below:

> **TSF & ICS user ZJ:** *As for me I cook using a pot with a handle, we hold this side and we manage to cook. But it may be difficult to those who do not have those types of pots.* (Interview # BK1).

> **Stove promoter SB:** *Some may be because they have a large family, maybe 10 children, it means they cook in a big pot.* (Interview # BK12)

> **Stove producer 1:** *Some say that it is difficult to cook on the stove (ICS), they say when they put a pot it slides. You know, it is because when we cook (nsima) on the three stone fire we use a piece of wood to support the pot.* (Interview # BK10)

For more evidence on this factor, see Chapter 6, section 6.3.1.4. This factor appeared to be one of the major constraint to ICS utilisation in this case study. In Chapter 7, I will discuss how participants of the

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[26] The elderly person's own words

BCCLW resolved the contradiction through practical experimentation of a modelled solution during the implementation stage of Expansive Learning.

Not accustomed to the ICS: Participants also expressed that most people do not cook on the ICS because they are accustomed to the TSF as illustrated below:

> *TSF & ICS user ZJ: Most people are used to the three stone fire, they are just used to the three stone fire and it becomes difficult to use the stove (ICS) because they feel that it is foreign […] they do not want to accept new things.* (Interview # BK1)

> *ICS user SM: People are not used (to cook on the ICS) maybe because the stoves are new, yet three stone fires have been around for a long time, so maybe they find it difficult to make fire on the stove and end up using three stone fire.* (Interview # BK2)

> *TSF & ICS user II: Even though we bought (the ICS), we are not used to it, that is why we use the three stone fire.* (Interview # BK3)

> *ICS user FJ: I think that they (people who don't use the stove) are just used to cook with the three stone fire.* (Interview # BK7)

> *Stove promoter SB: I think that they are used to cooking on the three stone fire, or maybe they do not have the interest […]* (Interview # BK12)

> *Stove producer 1: […] I also think that the problem with people is that the three stone fires are deeply seated in them.* (Interview # BK10)

> *Stove producer 2: […] we are so much accustomed to the three stone fire, and we have not yet transitioned, the stove is like a foreign thing. […]. They have not yet internalised (the ICS) but they have the interest to purchase (the stoves), sometimes they use both, they cook water here (stove) and there (three stone fire) they cook something else, and in so doing they feel that they are fast.* (Interview # BK10)

The citations above gave me the impetus to dig deeper to understand why, after purchasing the ICS because firewood is scarce and use of the ICS saves firewood, they would use the ICS sparingly because they are not accustomed to the ICS. I needed to understand what makes them fail to get accustomed to utilise the stove. I thus questioned whether this could be a problem with lack of both how-to-knowledge and principles-knowledge (Rogers, 2003). This provided me with grounds to analyse the learning interactions taking place among ICS actors and activity systems that could help me explain why sustained utilisation of ICS was problematic (see Chapter 5). Further, using the notion of explanatory principle found in both critical realism's causal mechanisms and CHAT's historical-genetic analysis, I was able to identify and analyse deep-seated problematic situations/(contradictions) that they encounter in their interaction with the new technology and between the activity systems that helped me explain better why things are the way they are (see Chapter 6).

Prestige: One participant expressed that some people may not use the stove because it is a source of prestige; they would keep it safe from breaking and may use it only when they have visitors in order to show-off a new technology:

> *TSF & ICS user ZJ: Some people may keep the stove and use it only when they have visitors.* (Interview # BK1)

This factor resonates with some findings from Chilije village case study. One participant expressed that she bought the ICS because she did not want to lag behind, among other factors that she provided (see Section 4.3.3.1).

Lack of small pieces of firewood: One participant expressed that when she does not have small pieces of firewood, she uses TSF. This is because the stove only allows small or split pieces of firewood. The quotes below provides evidence:

> *TSF & ICS user MB: I use the stove (ICS), but now I have no firewood. Can you put those on the stove? (Pointing at big logs). […] I am using the three stone fire because I have no firewood, when I have small pieces of firewood, I use that (ICS).* (Interview # BK8).

Stove delays cooking: Lack of speed when cooking was identified as a factor hindering use of stove, as indicated in the citations below:

> *TSF user RA: They use the three stone fire because it is fast, the stove delays cooking.* (Interview # BK9)

> *TSF & ICS user II: I find that the three stone fire is faster (than the ICS).* (Interview #BK3)

> *Field Facilitator LM: There could be many reasons for that one because others think that using three stone fire is faster than using Chitetezo Mbaula (the ICS).* (Interview # BK11)

> *Stove producer 2: […] they think that food takes long to cook because there are few pieces of firewood (on the ICS).* (Interview # BK 10)

For more evidence, see Chapter 6, Section 6.3.1.1. This factor constituted one of the contradictions that appeared to be among major constraints to ICS utilisation in this case study as well as in Chilije village case study (See Chapter 6, Section 6.5.1.1).

Difficult to re-make fire: One participant expressed that it is discouraging to use the ICS because it is difficult to re-make the fire when it goes out as shown in the citation below:

> *TSF & ICS user VN:* […] *what can discourage you is that sometimes when the fire is out, it becomes difficult to blow it up to start it again.* (Interview # BK4)

Negligence: The Field Facilitator and stove promoter expressed that some people fail to utilise the ICS because they are negligent as indicated in the quotes below:

> *Field Facilitator LM: […] it's just negligence because they don't see – some don't see the value of using the stove […].* (Interview # BK11)

> *Stove promoter SB: I think the problem is negligence.* (Interview # BK12)

Having more firewood at household: Participants identified the presence of more firewood at a household as a factor that can hinder use of the ICS as evidenced in the following citations:

> *Stove promoter SB: […] I also think that another problem is having more firewood at home and that makes them to cook on the three stone fire […].* (Interview # BK12)

> *TSF & ICS user II: It is because sometimes it is difficult to find firewood, and the ICS does not consume a lot of firewood compared to the three stone fire. So when I do not have enough firewood, I cook on the ICS.* (Interview # BK3)

> *Researcher: And when you have enough firewood?*

> *TSF & ICS user II: I cook on the three stone fire.* (Interview # BK3)

It is interesting to note that *TSF & ICS user II* acknowledged that firewood is difficult to find sometimes and that the ICS does not consume a lot of firewood, yet she does not continue using the ICS to save firewood. This kind of switching, as well as identification of many factors that hinder ICS utilisation persuaded me to dig deeper to understand further the causal mechanisms at work influencing decisions end-users make and explaining their actions as explained here. This led me to go beyond the surface to identify contradictions when end-users interact with the socio-technical innovation using CHAT, which I have discussed in Chapter 6.

4.3.2 Waziloya Makwakwa Village Case Study

4.3.2.1 Factors promoting uptake and utilisation

Time and firewood saving: Time and firewood saving promoted both uptake and utilisation. Participants indicated that they decided to construct an ICS because they were sensitised about the benefits it offers, and when they started using the ICS, they experienced the benefits, which led them to continue using the stoves. Time saving was evident in two ways: a reduction of firewood collection trips and saving cooking time. The citations below provide evidence:

> *ICS user RS: CADECOM told us that […]When you have constructed the stove, you can put one sizable piece of wood and two twigs only but you can cook all the dishes you want […] and all the dishes will be set at the table at the same time. Moreover, since I started using this stove I no longer have problems with firewood. Actually, last time I went to collect firewood was in October last year. I have used the firewood this whole rainy season […]. I have seen that it is different with the TSF because we used to put a lot of firewood on TSF, we were putting a lot and all that was burning and finishing at once, by the time we finish cooking, firewood is also finished.* (Interview # MZ6)

> *TSF & ICS user MP: […] CADECOM told us that the stove cooks well […]. Everything is prepared at the same time [...].You find that my daughter will be cooking here, that side she will put water, this side a pot of relish [….].* (Interview # MZ5)

Incentives: The project gives incentives in the form of best club awards in order to promote stove uptake. The award encourages end-users to encourage each other to construct ICSs. It is a big motivation

because they receive incentives such as goats, mattresses, etc. However, incentives were not identified as a factor promoting utilisation. The citation below illustrates how incentives encourage ICS uptake:

> *Project officer: Every year we have a best club award, which we give to the club that has done well, and we give them rewards. So […] we look at all the interventions (within the project). […] if a club has performed well in all the interventions except in increasing number of stoves constructed they would not receive the award. Therefore, they (club members and end-users) encourage each other, they will tell each other that we have done well in all the interventions and we would not like to fail because of lack of stoves, so you find that the whole village would encourage each other in order to get the award.* (Interview # MZ8)

4.3.2.2 Factors hindering uptake of ICS

Lack of kitchens: Due to the nature of the project, Integrated Community Development, which has sanitation component as well as the type of fixed stove, which has a chimney, the ICS is constructed in a kitchen. However, there was lack of kitchens in the project area at the commencement of the project, which delayed adoption (see Chapter 6, Sections 6.4.1.1 and 6.4.1.2). A TSF user also substantiated this:

> *Researcher: I have seen that you have a kitchen but you do not have a stove.*
>
> *TSF user FN: The proper kitchen is that one, so we had put pigs in it, but now we have removed the pigs and we will construct the stove.* (Interview # MZ4).
>
> *Researcher: So what specifically hindered you from having a stove?*
>
> *TSF user FN: As I said, the kitchen is the one (that hindered me).* (Interview # MZ4).
>
> *ICS user RS: Yes, those who do not have kitchens do not have stoves because the stove requires a kitchen […].* (Interview # MZ6).
>
> *Stove constructor 1: Some do not have a stove; we have not constructed the stoves because they do not have kitchens.* (Interview # MZ7). (See also Chapter 6, Sections 6.4.1.1, 6.4.1.2, 6.4.2.4 and 6.4.2.5 for more evidence and implications of lack of kitchens),

Laziness: A number of participants mentioned laziness as a factor hindering ICS uptake. However, the project officer felt that laziness was due to scarcity of stove construction materials. The following excerpts shows laziness as one factor hindering stove uptake:

> *Researcher: What is discouraging people who have no stoves from constructing the stove?*
>
> *ICS user LJ: Laziness.* (Interview #MZ1).
>
> *Researcher: Is there any other problem?*
>
> *ICS user LJ: Ah, laziness […] the problem is laziness that hinders them to go and learn from the meetings, they think that it takes away their time. But when we tell them that the stove is important and we should go together to learn at the sensitization meetings organized by CADECOM, they say you can go because it suits you. That kind of answer shows that someone is lazy.* (Interview #MZ1).
>
> *ICS user RS: They are just lazy …* (Interview # MZ6).

Despite that having no kitchens was identified as one factor hindering stove uptake, some participants had kitchens, but did not have a stove. This seems to be related to 'laziness' or the labour involved in searching for all the required materials as indicated under the next factor. In the excerpt below the participant had a kitchen but no stove, her response appears to echo the responses above:

> *TSF user AN: I do not have any reason (for not having a stove), but I admire the stove.* (Interview # MZ2).

> *Researcher: But you have a kitchen?*

> *TSF user AN: Yes.* (Interview # MZ2).

> *Researcher: So what exactly is the reason why you don't have a stove?*

> *TSF user AN: I am just busy, that is why I don't have a stove.* (Interview # MZ2)

However, later on the participant indicated that she was a laggard (see Section 4.3.2.2).

Scarcity of ICS construction materials: The second factor that was hindering uptake is scarcity of stove construction materials, cow dung and *ndhulani* as the following excerpts indicate:

> *Researcher: What other factors are limiting people to have a stove in their households?*

> *Field Facilitator FC: … the major one if we are looking at it, it's cow dung. …Ndhulani, we have it despite that it's so scarce.* (Interview # MZ10)

The project officer explained that scarcity of *ndhulani* might explain why many people are apathetic or lazy to construct stoves:

> *Project officer: Even though they said it is because of laziness, but I think that it is due to the scarcity of soil (ndhulani), because if the soil was available I am sure most people wouldn't be lazy. They would have been able to collect the soil around, but the distance they have to cover in search for the soil makes people lazy.* (Interview # MZ8)

Another TSF user substantiate this in the following talk turns:

> *Researcher: So now what limits you from having a stove?*

> *TSF user EC: It's laziness that made me fail to have a stove.* (Interview # MZ3)

> *Researcher: Are there any tools that discourages you from having the stove?*

> *TSF user EC: I did not find ndhulani, so I was discouraged.* (Interview # MZ3)

Initially, the participant attributed the lack of stove to laziness; however, when probed further with a specific question. the participant was able to point to the scarcity of stove construction material as the cause of laziness. This relates to the project officer's response above.

Another ICS user substantiated this:

> *TSF & ICS user MP: I think it is laziness since we have to go search for the construction materials, that is what makes them lazy. They say we have to go search for ndhulani, I think that makes them*

lazy. […] I think it's about scarcity of ndhulani not laziness. It's the scarcity of ndhulani. They feel lazy to go search for ndhulani and that discourages them. (Interview # MZ5)

Stove constructor 3: Some are lazy to go and search for the soil (ndhulani) I was talking about and the grass […]. (Interview # MZ7)

Participant 2: In fact, the problem for most people is laziness; to go search for the construction materials she is talking about becomes difficult. (Interview # MZ7)

The above quotes relate to the subsequent factor which touches on the search for construction materials.

Searching for stove construction materials: This factor particularly concerns the requirement to collect all the materials individually as a household in order to construct the stove. (See Chapter 6, Section 6.4.2.3 for evidence).

Cultural barriers: Cultural barriers were also found to be one factor hindering stove uptake; however this is related to the point above on scarcity of the material, specifically cow dung:

Project Officer: I was talking to a certain woman and she was saying that one problem is that in the Ngoni tribe, a woman does not enter a cattle kraal […] you cannot just enter a kraal, and get dung. […] so that is the main issue. Also not many people are keeping cattle […] and that is one reason making people lazy because they cover a long distance to find cow dung. (Interview # MZ8). (See also Chapter 6, Section 6.4.2.3 for more details on scarcity of cow dung and cultural barriers.)

Non-participation in sensitisation meetings: Participation in sensitisation meetings was an important factor in stove uptake. It appeared that construction group members were not willing to construct ICS for those who did not attend sensitisation meetings. The following excerpt illustrates this:

Researcher: I have seen that some people do not have stoves, why is that?

ICS user LJ: They want it that way; they did not want to be in the group. Most people have not entered the groups. […] most people do not have stoves because they do not go to learn the way we learnt, because they do not attend meetings. So they fail to construct the stove because they have not observed how it is done. […] Most people admire the stove and want us to go and construct them the stove, but then they do not attend sensitisation meetings. (Interview # MZ1)

Project chair: The problem is that most people admire the stove but they want someone to just go to their house and construct them the stove without them taking part. So do you think a person would do that (construct the stove)? (Interview # MZ1)

ICS user LJ: If the person can ask us humbly then we can go and construct the stove even though she did not attend the lessons (sensitisation meetings). It means she will learn right there when we construct the stove for her. (Interview # MZ1).

ICS user RS: They are apathetic; they do not attend meetings organised by CADECOM to learn. (Interview # MZ6).

Stove Constructor 1: For some, it is laziness, they do not want to attend lessons where we go to learn so that they know the benefits of stoves. (Interview # MZ7).

Laggards: One of the factors hindering ICS uptake was laggards as the following citation illustrates:

> *Project chair: I think… let me give you an example. When a new thing comes some people feel that it is not important, they say let me see how it goes. When they see that it is continuing, then they participate. Some are laggards, maybe I should put it that way, they want to observe and understand for a long time how that thing works. (Interview # MZ1)*

Another TSF user substantiated this:

> *TSF user AN: Ah, my heart was very far away from it (stove project) […] my heart was very far away from it, I was thinking which category are these things (the stove project)? Now I have seen that is it good. (Interview # MZ2)*

> *TSF user FN2: That time we did not understand the benefits of a stove. (Interview # MZ4)*

Aesthetics: The physical appearance of the stove, especially because it is made of clay discourages others from adopting the stove as indicated in the quote below:

> *Stove constructor 1: There are some people – neighbours that when they see the stove they will say so what is this for, you are destroying materials making this clay thing in your kitchen, no. So when you do not think properly about your future life, then you become discouraged and start thinking, what is this for? (Interview # MZ7)*

4.3.2.3 Factors hindering utilization of ICS

Participants mentioned the following factors as hindering ICS utilisation:

Improper construction of stove:

> *Researcher: What would make someone cook on TSF when she has a stove?*

> *ICS user LJ: This can be because the stove was not constructed properly; maybe it is not releasing fire. […] sometimes they open (the stove) when it is very dry after the prescribed number of days and this can make the fire fail to reach the pot. (Interview # MZ1).*

Lack of well-thatched kitchen:

> *ICS user RS: It is because the kitchen was leaking and it was right where the stove was. So it was difficult to make fire. And we had to go back outside (on TSF). This whole rainy season I have cooked on the open (TFS), but when the rains stopped we went back in (on the stove). (Interview # MZ6)*

Many dishes to prepare at the same time: As indicated earlier, most of the households that had ICS were using it exclusively. However, one household was found cooking on both TSF and ICS. She indicated that she uses TSF when she has many dishes to cook:

> *TSF & ICS user MP: I cook on the stove even though sometimes I cook on the TSF but it is not every day. This happens when all cooking places are filled, it means when we want bathing water we would put on TSF since I have girls, so they get the three stones and make the fire, but usually we cook on the stove. (Interview # MZ5)*

4.3.3 Chilije Village Case Study

4.3.3.1 Factors promoting ICS uptake

As in the other cases, there were a number of factors promoting ICS uptake. These included:

A sign of prestige: The ICS is also a sign of status for some people in the community, and it promoted uptake. This was also identified in Chapita village case study, although it did not feature as a factor promoting ICS uptake. The example below illustrates this:

> *Researcher: So what encouraged you to buy the stove?*
>
> *TSF & ICS user GW: I wanted to see because my friends were buying. So should I lag behind? I should also purchase.* (Interview # DZ1)

Firewood saving: One participant identified firewood saving as a factor promoting ICS uptake:

> *TSF & ICS user GW: Since they were saying, go and buy (the ICS) because it does not consume firewood.* (Interview # DZ1)

This is similar to the other case studies in that firewood saving promoted both uptake and utilisation.

Top-down approach and /or command from chief: I also found that some households purchased the ICS because the Village Chief had issued a command as evidenced from the citation below:

> *Field Facilitator JK: […] And then such people are the ones that will continue buying the stove other than those that have ended up adopting the stove because the Village Head had said so. Sometimes the Village Head had to say if you don't do ABC, then you will face this punishment.* (Interview # DZ3).

Giving out free stoves: During the group interview members explained that most of them were giving out free stoves to some community members. However, some members felt that it was not a good thing to make such revelations about the frustrations that led them to give out free stoves. The following talk-turns illustrate the sentiments and provide the evidence:

> *Researcher: Do most people buy stoves or they are given?*
>
> *Stove producer 1: Some buy.*
>
> *Stove producer 4: Some not, they are given.*
>
> *Researcher: But were most people buying or given?*
>
> *Stove producer 3: Please answer the question women, maybe because the stoves were just heaped you were just giving out.*
>
> *Stove producer (chorus): You were just giving… we were just giving out.*
>
> *Stove producer 2: Since the stoves are just heaped, we were giving out free […] we were just giving out free.*
>
> *Researcher: So are you saying most people did not buy the stove?*
>
> *Stove producer (chorus): No*

Stove producer 3: Are you sure you were just giving?

Stove producer 5: Should we tell lies?

Stove producer 1: No, is there somebody who received money?

Stove producer 5: We were just giving them out, get a stove, you should not worry, here is a stove.

Stove producer 2: Take one, the stoves have no purpose at all, we produced them ourselves

Researcher: They have no purpose?

Stove producers (chorus): Yes! (Interview # DZ5).

The above talk turns indicate that some producers were giving out free stoves mainly because of marketing problems (see Chapter 6, Section 6.5.2.3 for details on marketing problems). However, some end-users indicated that they had bought the stoves. These bought the ICS during the first cycle of production, when the group sold the stoves through Concern Universal, and before they started experiencing marketing problems. The following citation illustrates that some people purchased the stoves:

> *TSF & ICS user GW: We knew about the stove when the production group started producing stoves and we went to buy. […] they said they had started making stoves and we went to buy at K300, these are from the first cycle.* (Interview # DZ1)

Additionally, more evidence shows that some people did not get a free stove (see Section 4.1.3.2).

4.3.3.2 Factors hindering ICS uptake

Financial status: Despite evidence showing that some people received free stoves as pointed out earlier, others had no stoves because of financial constraints as the following citations illustrate:

> *Researcher: So in the way you are putting it you really want the stove.*
>
> *TSF user NG: Yes.* (Interview # DZ3)
>
> *Researcher: So what prevents you?*
>
> *TSF user NG: Money.* (Interview # DZ3)
>
> *Researcher: So do you think that some people may not afford the stove at the current price?*
>
> *TSF user NG: Yes, that price may be unaffordable for people in the village. (*Interview # DZ3)

The Field Facilitator also substantiated this:

> *Field Facilitator JK: Others have expressed concern that maybe it's expensive to buy clay like this.* (Interview # DZ6)

Availability of firewood: Availability of firewood was identified as a factor hindering ICS uptake. This resonates with what Barnes at al. (1993) observed (See Chapter 1, Section 1.4.4.1). This in a way means that when fuelwood is available uptake may be hindered, as well as utilisation. (see also Section 4.3.3.4). The citation below illustrates this:

Field Facilitator JK: […] Uptake wasn't good. We struggled a lot. In Dedza […] we still had some trees around, so this affected the rate of adoption and usage of the stove. […] it's because they will just say, ah, I think we have a lot of wood, why should I bother to save wood. I just go out get a piece and life goes on. (Interview # DZ6)

Mind-set and/or resisting change: The Field Facilitators also were of the view that people's mindsets prevent them from up taking the ICS in the following citations:

Field Facilitator JK: But sometimes it's just mind set […]. I think it is just resisting change- people will resist any technologies. (Interview # DZ6)

Another Field Facilitator explained that the mind-set is due to the availability of firewood:

Field Facilitator MB: For them to change mind-set it's not a one day's job. For some they feel there is no need to change since they say the stove uses three pieces of firewood, but we do not have problems with firewood. (Interview # DZ7)

4.3.3.3 Factors promoting utilisation of ICSs

Lack of kitchen: A lack of a kitchen was indicated as a factor that promoted use of the ICS. This factor is linked to the portability of the stove, which is one benefit of the Chitetezo Mbaula that a TSF lacks. The excerpt below provides evidence:

ICS user BP: It's because I had nowhere to cook because it was during rainy season. … So, during rainy season I put it on the verandah. (Interview # DZ2)

ICS accommodates alternative fuels: One factor that promoted ICS use is that the Chitetezo Mbaula can accommodate other fuels, other than firewood. The following except illustrate this:

ICS user BP: It's because you cannot be stranded with fuel … because you can use even trash, or maize cobs (residues). (Interview # DZ2)

Provision of alternative cooking device to save cooking time: The ICS offers an alternative cooking device to women. Participants indicated that they switch between the ICS and TSF in order to prepare both relish and *nsima* at the same time in order to save time. Stove producers also provide evidence of this:

Researcher: So what exactly is the reason why you do not cook on the stove since you know the benefits? (Interview # DZ5)

Stove producer 2: We cook some food on the stove, some on the TSF. (Interview # DZ5)

Stove producer 5: It works better that way. (Interview # DZ5)

Stove producer 1: It works better. (Interview # DZ5)

Stove producer 2: It means here the relish is cooking, and here the nsima is cooking, and it works. (Interview # DZ5)

Researcher: So you switch between the stove and… (Interview # DZ5)

Stove producers (chorus): …TSF. (Interview # DZ5)

Stove producer 2: So that it works for us, since we are in the village … as for me I want everything to be ready at the same time. (Interview # DZ5)

Stove producer 6: As for me, I have the stove it is in the house. So what we do, we use TSF in the kitchen, and outside we use the stove … so that we cook quickly. (Interview # DZ5)

Stove producer 1: It's because after you come back from the garden you want to cook everything quickly. (Interview # DZ5)

Stove producer 3: The thing is that when we come back from the garden you feel that you should make fire on two places in order to be quick. (Interview # DZ5)

Stove producer 2: We want things to boil at the same time. (Interview # DZ5)

Stove producer 1: As for me I have three stoves, … the other one I use it like a chair, the other I cook on it and the other I just took it out it's new I have not started using it. I also use TSF. (Interview # DZ5)

Another end-user substantiated this:

TSF & ICS user GW: In the morning, she (my daughter) makes two fires one in the kitchen another one on the stove. She cooks her breakfast on the stove. […]so that she is not late for school because if she waits for the TSF alone, she maybe late, and she may end up going hungry to school. (Interview # DZ1)

Even though most of the production group members had more than one ICS, they were not using them at the same time. They instead used either a TSF and an ICS, or sometimes two TSF places and an ICS. There was no house that was found using two ICSs at the same time even though they had two or more ICSs. *Stove producer 1's* last comment above provided a picture of what was happening in most households that had more than one ICS.

Saving cooking time seems significant in promoting use as it was also observed in Waziloya Makwakwa where households who had an ICS rarely abandoned it despite the contradictions identified because it saved cooking time, since it has three cooking places (see Section 4.3.2.1). The ICS provides the convenience the women are searching for in the cooking activity.

Shortage of firewood at the household level: Having a low source of firewood at the household was found to promote use of the stove. Barnes et al. (1993) also made similar observations, as pointed out earlier. Some participants indicated that when they run out of firewood, they use the ICS as evidenced in the following excerpts:

TSF & ICS user GW: You can cook on the stove with less firewood, so when I have less firewood I use the stove so that it works for me. (Interview # DZ1)

This tendency was also identified in Chapita Village case study. It also corresponds with the finding that availability of firewood in the area discourages people from using the stove.

Presence of Field Facilitators during the existence of the project: The Field Facilitator indicated that when they were present in the community, people were using the ICS, which they stopped when the project phased out:

> **Field Facilitator JK:** *[…] they were using the stove when they bought it maybe because there was somebody who was always going around when the project was still there. So maybe they were doing it for our sake not that they realised what they actually (are) supposed to achieve from that. […] Others they just used for a week or so, and then they stopped.* (Interview # DZ6).

Giving out incentives: Provision of incentives also promoted the use of the ICS as evidenced in the citation below. However, the incentive did not influence sustained use:

> **Field Facilitator JK:** *There was a campaign we were giving out like tokens to villages that adopted the stove 100% and there are villages that adopted the stove 100%, every household had a stove and that time they were using the stove. But now I think they got the price, they chose what they wanted […] some people chose livestock […] but then because that time the project was still there. Now upon realising that the project phased out they stopped , which is very unfortunate because it means that they actually didn't get the reason for using the stove and how I wish that we could continue this one, there was hope that time we were going to continue with implementation of the project to intensify, at least if we could have stayed longer maybe they would have internalised and then accept that we are in this situation we actually have to do something about it.* (Interview # DZ6)

This factor relates to the preceding one. Additionally, it relates to the factor that lack of encouragement from stove implementers hinders utilisation of the ICS as pointed out in Chapita village case study (see Section 4.3.1.4).

4.3.3.4 Factors hindering utilisation of ICSs

The stove slows down cooking: This factor was common between Chapita village and Chilije case study as hindering ICS utilisation. It constituted one of the contradictions 6.3.1.1 and 6.5.1.1 within the TSF and ICS user activity system. (See Chapter 6, Sections 6.3.1.1 and 6.5.1.1 for evidence on how it hinders utilisation).

Availability of firewood: Availability of firewood was also identified in Chilije village case study as a factor hindering ICS utilisation. The following talk turns from a group interview with stove producers provides the evidence:

> **Researcher:** *So what exactly is the reason why you do not cook on the stove since you know the benefits?* (Interview # DZ5)

> **Stove producer 4:** *After all firewood is abundant here […] firewood is abundant here.* (Interview # DZ5)

> **Stove producer 2:** *We have firewood.* (Interview # DZ5)

> **Stove producer 1:** *We are proud of the abundant firewood.* (Interview # DZ5)

> **Researcher:** *So it is because you have abundant firewood?* (Interview # DZ5)

Stove producers (chorus): Yes. (Interview # DZ5)

Stove producer 5: A lot. (Interview # DZ5)

Researcher: And it is because you are proud of the firewood? (Interview # DZ5)

Participants (Chorus): Yes. (Interview # DZ5)

The Field Facilitators substantiated this:

Field Facilitator MB: [...] there are some villages that usage of the stove is still problematic. What I have realised is that, since the idea was to reduce the amount of firewood used, and that side they don't have problems with firewood. So maybe that is the reason why most people feel that the stove is not important because at present that side they do not have problems with firewood because of Dzalanyama (forest reserve). (Interview # DZ7)

Field Facilitator JK: So you find that people around the forest it's so difficult for them to appreciate the importance of the stove [...] because they are looking at the trees that are there.[...] It goes down to the fact that people don't produce money to get firewood. [...] They look at the wood that is there, they look at the tree that is there, they don't know how much damage has been there. (Interview # DZ6)

End-users also confirmed this:

TSF & ICS user YT: For me I think the main reason is what I was just saying that the forest is near and most people just go and collect firewood, and when they collect the firewood, they feel like they are delaying when they cook on the stove, so they instead cook on the TSF because they are used. [...] The problem is that in other areas maybe they use the stove because they lack firewood. But here we are used to put a lot of firewood, we just put a lot of firewood so that the food is cooked quickly. (Interview #DZ4)

Fear of preparing not thoroughly cooked food on the stove: One male participant mentioned fear of preparing not well-cooked food from the ICS:

TSF user NG: [...]. Some people also think that the fire on the stove goes to one direction only [...] they think that fire goes to one side of the pot, that the other side will be cold and the food will not be cooked, and they are afraid the spouse will slap them [Sic]. You see what I am saying may sound a lie or crazy, but many people are afraid that they may prepare not well cooked nsima and it may be embarrassing if their spouse mentions it, hence they stick to TSF. (Interview # DZ3)

Fear that the pot may fall off when they cook: Another factor that I found prevents people from using the stove is that people are afraid that the pot may fall off when they cook. This is mainly when they cook *nsima* because the pot slides, which was expressed in Chapita village case study, making it difficult to cook *nsima* (see Section 4.3.1.4). It also constitutes one contradiction in Chapita village case study (see Chapter 6, Section 6.3.1.4).

TSF user NG: Some say when they cook on the stove the pot will fall off. (Interview # DZ3)

Not accustomed to the ICS: Another factor identified was that people have not adapted to cooking with the ICS:

> **Stove producer 3:** *It shows that we are not used to the stove […] since the thing is like a new thing.* (Interview # DZ5)

> **Stove producer 2:** *We are not accustomed to the stove.* (Interview # DZ5)

> **Stove producer 3:** *We will get accustomed in the near future when firewood becomes scarce […] we will get used since the stove does not consume a lot of firewood.* (Interview # DZ5)

> **Stove producer 1:** *We will get used especially now that the foresters/soldiers are guarding the forest[27] that will make us get used to the stove.* (Interview # DZ5)

> **TSF user NG:** *Ever since people have been used to cook on TSF so now on the stove, people see that it is a new thing, of course sometimes it is about our ignorance. And sometimes it is about the perception that I was talking about that the pot will fall off.* (Interview # DZ3)

As discussed earlier (see Section 4.3.1.4 for details), this factor was a catalyst for digging deeper for more insight into deep-seated systemic tensions between activity systems.

Lack of sensitisation, cooking demonstrations and encouragement from stove project implementers: Lack of Controlled Cooking Tests (CCT), sensitisation and encouragement from stove project implementers was identified as one reason hindering use of the stove as the following excerpts illustrate:

> **Field Facilitator MB:** *Because they are some people that bought the stove but they were not exposed to this (CCT) demonstration in order to appreciate (stove performance).* (Interview # DZ7)

> **TSF & ICS user YT:** *If the implementers were coming to encourage the people, maybe people could be remembering that they are encouraged to cook on the stove and that the stove is important in different ways; that would make them believe that the things (the stoves) are important. But because they do not come, people become apathetic that after all the ones who brought the development do not encourage us, maybe they do not use the stoves themselves.* (Interview # DZ4)

> **TSF user NG:** *People are not using the stove because there are no sensitisation meetings. When you are being initiated, you understand when they put you through the initiation ceremony where they tell you that these lessons should be understood. The lessons come from those who are already initiated; those are the ones who should be telling us to understand things. But they just brought the stoves without instructions, that is why things are the way they are (people are not using); because they just brought the stove and said go and cook with the stove, but they did not give instructions. For example, my sister she stays there where there is a tree, she has stoves but she cooks on TSF. This is a result of having no meetings where you can discuss how to handle or use the stove.* (Interview # DZ3)

This factor was also identified in Chapita village case study (see Section 4.3.1.4) and it constitutes one of the contradictions in Chapita village case study (see Chapter 6, Section 6.3.3.1). It also opened up

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[27] During the time of data collection, the government had deployed some foresters and soldiers to guard the Dzalanyama Forest Reserve especially those that were burning charcoal. When a person was caught, she or he was heavily fined and /or sometimes whipped. *[sic].*

further examination on the learning interactions existing between activity systems as presented in Chapter 5.

Difficult to make fire: Participants also indicated that they sometimes avoid the ICS because it is difficult to make the fire required because the stove needs to face the direction from where wind is blowing. The excerpts below provide evidence:

> *Stove producer 4: The problem is that the fire on the stove is difficult (to make) because the place for putting firewood is only one.* (Interview # DZ5)

> *TSF & ICS user GW: In the kitchen (TSF) it is not difficult to make fire […], here (on the stove) fire burns quickly when the wind is blowing like this and when the door faces the direction where the wind is coming from, when that happens then things will go well.* (Interview # DZ1)

> *Researcher: And when wind is not blowing?*

> *TSF & ICS user GW: Nothing happens.* (Interview # DZ1)

> *Stove producer 1: The thing is the stove has a specific direction where it should face, it needs the door to face the direction from where wind is blowing in order for the fire to start quickly.* (Interview # DZ5)

> *TSF &ICS user YT: Some people say it is difficult for them to make fire on the stove, but some say it is not difficult. Still some people say it is difficult to make fire.* (Interview # DZ4)

A similar factor was identified in Chapita village case study; however, in Chapita it was about re-making the fire when it goes out (see section 4.3.1.4).

Apathy towards the ICS: One stove producer indicated that sometimes some people do not use the stove because they are apathetic:

> *Stove producer 4: Sometimes it's just apathy, it's just apathy.* (Interview # DZ5)

Crack on the upper door: The crack was also found to be one factor why some people may not use the ICS as the following excerpts illustrate:

> *Researcher: Do you think the crack can make somebody to feel like not wanting to be using the stove because it is breaking?*

> *Field Facilitator JK: Yea, some people have had that as a reason not to use the stove.* (Interview # DZ6)

> *TSF user NG: I have heard some people saying that the stoves are not durable, they break when you start cooking on them.* (Interview # DZ3)

This factor was also identified in Chapita village case study.

Top-down approach and / command from Village Chief: Top-down approach to stove dissemination was found to be among the factors hindering ICS use. However, as pointed out earlier, it promoted uptake as community members unwillingly purchased ICS because they were afraid of punishment from the

Village Chief (see section 4.1.3.1). This scenario explains why the command hindered ICS use. The following excerpts illustrate this:

> **Researcher:** *So why do you think somebody could buy a stove and then just leave it, and use the TSF?*
>
> **Field Facilitator JK:** *Because the Village Head (Chief) said everybody has to have the stove. Coming as a command from the village leader, so you have to do as above.* (Interview # DZ6)

The chair of the production group substantiated this during a group interview when I wanted to understand why they continue using the TSF when they know the benefit of the ICS:

> **Stove producer 3:** *Since they just brought us these things (ICSs), it is also taking us time to get accustomed, to stop our old ways.* (Interview # DZ5)

The citation from *stove producer 3* seems to indicate lack of participation of end-users in the dissemination of the socio-technical innovation, which relates to two contradictions identified (see Chapter 6, Sections 6.5.2.5 and 6.3.3.1).

Receiving a free stove: Receiving a free stove facilitated uptake of the stove as discussed earlier. However, the citation below shows that a free stove hindered ICS use:

> **Field Facilitator JK:** *So you could have maybe five out of ten buying and then using the stove consistently. The other half they wouldn't use it, especially those that get it free, then they didn't continue using the stove.* (Interview # DZ6)

However, evidence shows that a number of factors could be at play. As discussed earlier, one of the two ICS users who participated in the study received a free stove and she used it exclusively because for her the free ICS brought a lot of convenience as she had no kitchen (see Section 4.1.3.3).

4.3.4 Cross case analysis on the factors that promote and hinder ICS uptake and utilisation

I identified a number of factors promoting and hindering both uptake and utilisation in all the case studies with several similarities between Chapita and Chilije village case studies. While in Chapita and Chilije village case studies, a participant would give a number of reasons as they tried to justify unsustained use or abandoning the ICS, participants in Waziloya Makwakwa Village case study usually gave two to three reasons for failure to uptake or construct an ICS. It is difficult therefore to point at one factor as hindering uptake and / utilisation of the ICS based on the data presented in this chapter alone. This opened up a deeper analysis of the problematic situations to identify contradictions constraining ICS uptake and utilisation as discussed in Chapter 6, with the purpose to work with participants to find ways of resolving the contradictions as discussed in Chapter 7.

Further, in examining the factors that hindered ICS utilisation, one theme that emerged was the need for convenience during the cooking activity; this was the matter of concern influencing participants' actions in switching between the TSF and ICS, or in abandoning the ICS, particularly in Chapita and Chilije village

case studies. While in the two case studies, participants' responses indicated either the search for convenience or creation of convenience in the cooking activity, in Waziloya Makwakwa case study participants appeared to have attained convenience mainly due to the three cooking place stove. The search for convenience in the activity of cooking relates to lack of end-user satisfaction with the innovation (see Section 4.4.). Examples of factors where the theme of convenience is evident are included in Sections 4.3.1.1, 4.3.1.3, 4.3.1.4., 4.3.2.1, 4.3.2.3, 4.3.3.1, 4.3.3.3, and 4.3.3.4.

The fact that scarcity and costliness of the fuels may be a stimulus for utilization of ICSs as indicated earlier seems to agree with the findings across the case studies of Chapita and Waziloya Makwakwa (see Section 4.3.1.3, 4.3.2.1). However, scarcity of firewood did not induce *sustained* use in Chapita Village case study. This is due to contradictions identified when end-users interact with the ICS innovation as discussed in Chapter 6. As regards Chilije village, the availability of firewood hinders utilisation among other factors (see Section 4.3.3.4). This also relates to Barnes et al.'s observation in that when the firewood is abundant, it can hinder utilisation of ICS.

4.4. Profile of uptake and utilisation of ICSs at national level

This section provides a picture of the level of uptake and utilisation of ICSs at a national level, specifically, under the National Cook Stove programme. It also provides one major factor hindering utilisation of ICS at national level using interview data obtained from the Deputy Director of the Department of Energy Affairs (DoEA) and the Coordinator of National Cook Stove Steering Committee (NCSSC). The DoEA and the NCSSC form the policy activity system.

Previous efforts by ProBec-GIZ and DoEA had proved that ICS uptake was problematic in the country. However, there were a few examples of success stories as far as ICS uptake was concerned in Traditional Authority Nsamala in Balaka district, under Nsamala Sustainable Energy Project. The following citation illustrates this:

> ***Coordinator NCSSC YB:****…there have been efforts before with the Department of Energy and other players like ProBec-GIZ project based in Mulanje… Most of what we call stoves in Malawi were developed under the ProBec programme. They focused on developing the technologies and using others to roll them out but the progress was not very good. But, when we partnered with them for them to give us the skill in Balaka, that was the time that it really demonstrated that if you do a bit of social marketing, etc. that cook stove roll out should not just be oh here is the stove buy it, it should be about behaviour change intervention. […].So in Balaka we used various techniques […]. So the moment many people adopted through that (using various techniques); they became like testimonies to the others and the thing spilled out (spread) […].* (CP LL1)

Nevertheless, in August 2014 at the start of the study, I gathered that uptake was not a big challenge because about 90% of the stoves that were produced with financial support from National Cook Stove programme were sold as the Deputy Director of DoEA explained:

> *Deputy Director TS DoEA: So, so far I can say about 13 000 -14 000 stoves have been produced, but that one I can cross check to give you exact information on that one. So maybe over 90% (of stoves) have been bought. But when you talk of - back to you question - what is the uptake like, if the sales are anything to go by, then we can say there is over 90% uptake … (CP LL1)*

During the first phase of the study in June 2015, I followed up with the DoEA to track the profile of ICS uptake nationally. According to the Deputy Director, the situation had remained the same:

> *Researcher: … I just wanted to know what has been the progress in terms of uptake of the cook stoves from that time up to this time, if there is any progress in terms of national programme.*

> *Deputy Director TS DoEA: I think I can say so far there isn't much improvement, the status quo still remains.* (Interview # BK13)

On the contrary, there were some challenges with ICS utilisation as indicated in the following citation:

> *Deputy Director TS DoEA: … But we haven't really seen these stoves substituting the TSF whereby those who were using these (TSF) have completely abandoned (them) and opted for these (ICS). So others even if they buy the stove they still use the TSF place. So, when we talk of about 100% adoption that is a challenge for people to completely abandon the TSF and opt for the stoves, so that's where maybe the biggest challenge would be.* (CP LL1)

One major reason that could explain why utilisation of the ICS was low according to the Deputy Director is lack of end-user satisfaction with the innovation:

> *Researcher: So if you were to say what could be the major reason, or the major challenge that is limiting the end-users to actually use the stoves, what could you think of?*

> *Deputy Director TS DoEA: For sure, they are not satisfied, they are not getting any better, or their lives are not improving with the stoves, they are finding the stoves no better than the three stone fire. […] If today you buy somebody who has never used a shoe a pair of shoes, even the cheapest you give him or her, if he uses today and tomorrow he abandons them, then you should know that it has not made a difference. But if you buy a pair of shoes and give to somebody and he clings to it till it wears off from the feet then you should know it has filled a gap, it has filled a need. So to me I feel maybe we are missing a point, we are not addressing the issue, so that's the biggest challenge. It's not that the people don't know, they know. It's not that they don't know the advantages, they will tell you. […]. So satisfaction that's the issue.* (Interview # BK13)

From the citations above, uptake was not problematic, but utilisation was still a challenge in the years 2014 and 2015. The main factor hindering utilisation of ICS from the perspective of the Deputy Director of DoEA at national level echoed the main theme of searching for convenience running through the chapter that explains end user actions in switching between ICS and TSF or abandoning ICS.

4.5 Conclusion

This chapter has discussed the profile of ICS uptake and utilisation in the three case study sites and at national level. I have provided the profile of uptake and utilisation of ICS in the three case studies first, quantitatively and second, qualitatively using participants' own words to augment quantitative data. The qualitative aspect was presented in four categories as factors promoting and hindering uptake and

utilisation. In terms of national level, the findings presented relied on qualitative data only. In the Chapita and Chilije Case studies, uptake was not a challenge, despite few cases where participants had no ICS. However, sustained utilisation was a challenge. The findings indicated that a majority of end-users switched between TSF and ICS, or in some cases, they abandoned the ICS. On the contrary, the findings indicate that the main challenge in Waziloya Makwakwa case study was uptake, rather than utilisation. Most of the participants who own an ICS in Waziloya Makwakwa utilise the stove; it appeared that they do not use it in combination with TSF. This appears to be due to the stove design, which has three cooking places and one place for loading firewood that offers and echoes the theme of convenience as expressed through time-saving aspects (cooking time and firewood collection time), identified as the major reasons for sustained utilisation of ICS in the case study (see Section 4.3.2.1).

The underlying causal mechanisms that explain end-users' actions in all case studies (both in purchasing and/or constructing the ICS, and using it, switching between the TSF & ICS, or abandoning it) is the search for convenience during the cooking activity, which relates to lack of satisfaction with the technology (see Section 4.4).

Further, the findings on the profile of uptake and utilisation in Chapita and Chilije village case studies resonate with the national level views. At a national level, uptake was not reported as a challenge, but utilisation was (see section 4.4). The Chitetezo Mbaula, the baseline ICS promoted nationally by the NCSSC, in conjunction with partner institutions and commonly promoted in most parts of the country by other institutions and individuals is the one available in the two case studies. This appears to imply that end-users using Chitetezo Mbaula may be facing similar problematic situations, particularly in using the ICS at national level.

In addition, some factors constitute contradictions as presented in Chapter 6. However, some do not. Thus, analysing the uptake and utilisation of ICS and factors promoting and hindering uptake and utilisation, required developing a more comprehensive picture of the learning taking place within and between activity systems. In the next chapter, I analyse and discuss the learning interactions. Secondly, the findings from this chapter laid the initial stage for the identification of contradictions, which are analysed and discussed in Chapter 6.

CHAPTER 5: LEARNING IN IMPROVED COOK STOVE SOCIO-TECHNICAL INNOVATION

5.1 Introduction

This chapter answers question 2: What learning interactions take place among improved cook stove (ICS) technology actors, what do the actors learn during interactions and how do they learn ICS technology?

This chapter used a combination of inductive and abductive analysis. I used Cultural Historical Activity System's (CHAT) second and third generation activity systems to analyse the interactions, and learning interactions taking place within and between subjects of interacting activity systems. I drew from Engeström (2009) who contended that any theory of learning must answer four questions: Who is learning? Why they are learning? What do they learn? How do they learn? (p. 53). (See Chapter 3.) Using this framework, I identified the subject of the learning in each interaction, and the content of the learning, which was also guided by the identification of interacting activity systems in ICS practice as described in Chapter 4, Sections 4.2.1.1 & 4.2.2.1) in the three case studies as described below. I also drew from several learning theorists to understand how the subjects learn (see Chapter 3).

The study sought to investigate the learning taking place among actors in the ICS practice in order to identify existing gaps in the way key actors are learning the ICS innovation. Identification of the gaps are significant in two ways: First, it helped me explain why sustained use of the ICS was problematic, (particularly in Chapita and Chilije village, with an exception of Waziloya Makwakwa case study where uptake was a challenge, as discussed in Chapter 4). Second, it is the point of departure for facilitating expansive learning processes, which may have implications for sustaining uptake and use of the ICS. (See Chapter 7).

The chapter discusses the findings on the learning taking place among actors in ICS practice in the three case studies as well as at national level fora. The chapter discusses the learning subject in each learning interaction identified, the content of the learning and the ways in which the subjects are learning ICS innovation. It identifies and discusses the directionality of the learning interaction in each case study. However, it does not discuss the question *why* the subjects are learning (as proposed by Engeström, 2009) because this was given by the nature of the object under study. I therefore felt that it was not significant to engage further with research participants on this question.

Further, the chapter discusses the implications of the existing gap identified in the way actors are learning ICS innovation. The gap identified is in terms of the emphasis put on the learning of the ICS innovation which is more informative, rather than transformative (Kegan, 2009), which has resulted in single loop

learning, as opposed to double loop learning (Brown and Vergragt, 2008). (See Chapter 3.) This gap necessitated the foregrounding of contradictions (see Chapter 6) as a potential driving force for change and development (Roth & Lee, 2007) coupled with DWR using the BCCLW methodological tool. Hence, this chapter lays the foundation for Chapter 6.

In order to discuss the questions, I will start by describing the interacting activity systems; this includes the history of the development of the activity systems. Then my focus will shift to learning interactions and the content of the learning, followed by the various ways, key actors are learning the ICS innovation. This will be followed by a discussion on tenuous interactions among some actors. Implications of the findings will be discussed at the end of the chapter.

5.2 Description of interacting activity systems in the three case studies

This section describes interacting activity systems that I identified in the three case studies. I will start by providing a brief history of the development of each activity system in each case study, which will be followed by a description of the activity systems using a diagrammatic form of CHAT second-generation activity system.

5.2.1 Activity systems in Chapita Village case study

I identified eight activity systems including policy activity system, implementer activity system, promoter activity system, trainer activity system, stove production activity system, improved cook stove (ICS) user activity system, three stone fire and improved cook stove (TSF & ICS) user activity system, three stone fire (TSF) user activity system as described below.

5.2.1.1 Policy activity system

The Department of Energy Affairs (DoEA) constitutes the policy activity system. DoEA operates under the Ministry of National Resources Energy and Environment. The Department is responsible for all energy matters. The Department has worked and cooperated with various partners and programmes in the renewable energy sector. There are many renewable energy efficiency initiatives developed by the Government of Malawi, with most of them under the mandate and responsibility of DoEA, in collaboration with other ministries such as the Ministry of Economic Planning and Development and Ministry of Energy and Mining. The initiatives were undertaken to minimise the use of biomass fuels (Malawi. Ministry of Environment and Climate Change Management (MECCM), 2012) (see Chapter 1). As indicated in Chapter 1, the notable ones include NSREP, PAESP, BARREM and ProBEC (see Section 1.4.4.2). In addition, a National Energy Policy was approved in 2003, under the responsibility of DoEA (see Chapter 1). As part of the National Energy Policy, a Renewable Energy Framework was launched in order to bring

more coherence to renewable energy developments particularly at the national, grid-level scale but also with some focus on the local, off-grid scale (Malawi. MEM, 2003).

In 2009, the Poverty Environmental Initiative Malawi was initiated to support government in addressing environmental degradation concerns, which was felt to have serious economic implications (United Nations Development Program-United Nations Environment Programme-Poverty Environment Initiative, (UNDP-UNEP-PEI), 2015b). It was led and implemented by the Ministry of Economic, Planning and Development and Ministry of Energy and Mining, which included DoEA.

As discussed earlier, in 2013, inspired by the Poverty Environmental Initiative pilot projects the then Head of State and Government, Her Excellency Dr. Joyce Banda, launched a similar initiative in Balaka district as a commitment to the Global Alliance on Clean Cook Stoves (see Chapter 1, Section 1.4.4.2). With support from Irish Aid and United States Agency International Development (USAID), the initiative aimed to upscale energy efficient cook stoves and sustainable energy production as an environmentally sustainable option for improving energy provision, building on the experiences and lessons learnt from the Ministry of Energy-Poverty Environmental Initiative supported pilot projects (UNDP-UNEP-PEI, 2015a). Following this, a Cook Stove Programme Road Map was developed between 2013-2014 with the object to catalyse sustained uptake of clean and efficient cook stoves in Malawi and a National Cook Stove Steering Committee (NCSSC) was set up to oversee and spearhead the commitment (Chisoni, 2014). The DoEA chairs the steering committee.

The NCSSC conducted a pilot phase from March 2013, however, there were a number of challenges. The major ones include: how to motivate end-users to adopt and use the cook stove; quality of clay soil for producing the stove particularly (Chitetezo mbaula), including lack of expertise on clay testing in the country; standardisation of the stove dimensions, which was partly resolved by the introduction of the paddle mould; high deforestation levels in some areas with acute scarcity of firewood, which makes it difficult to find firewood for firing the stoves; and marketing and distribution of the stove, especially due to problems with transportation (this is because the stove is mainly produced in the rural areas, but designed to feed urban areas as well). Since the stove weighs about 10 kilograms, there is need for transporting by vehicle, and this raises the price of the stove (Chisoni, 2014).

The policy activity system does not interact directly with other activity systems on the ground, except the implementer activity system. However, it has influence over the type of cooking technology disseminated in the three case studies. This is through advocating the provision and promotion of low-cost energy efficient technologies for household use (Malawi. MEM, 2003) in order to make the technology affordable and accessible to many people especially the rural poor populations in the country.

Figure 5.1 shows the policy activity system. It highlights among other things, the object of activity, which is to roll out ICS for convenient low energy cooking, with a target of two million ICSs by 2020 as the main outcome. The rule governing the actions of the subjects is dissemination of low-cost technologies for affordability by the rural population. The main instrument is the Cook Stove Road Map document.
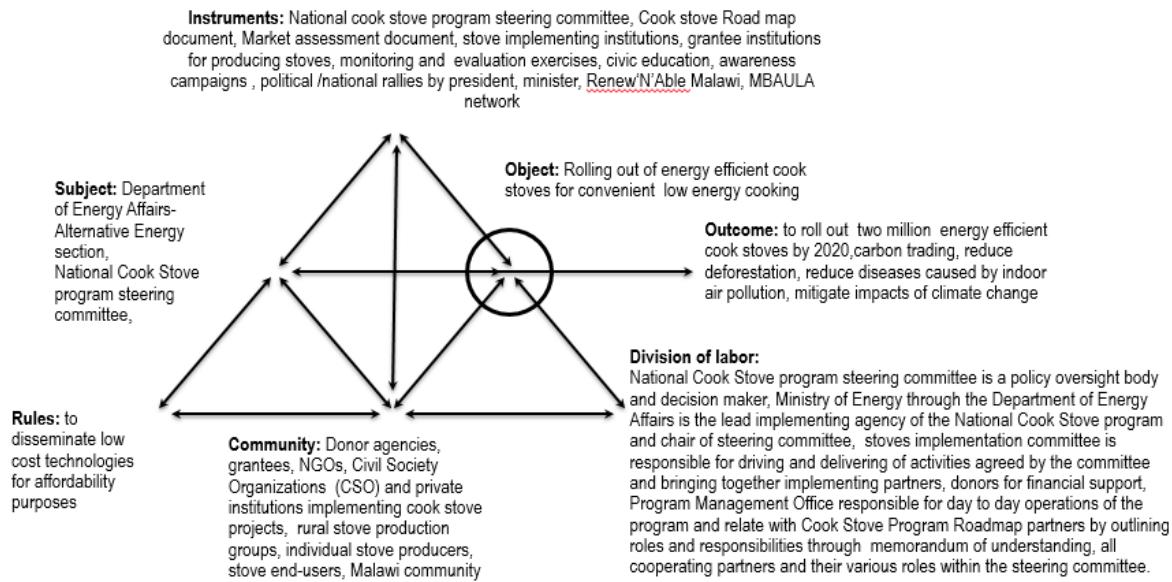
Figure 5.1: Policy activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research (2003)

5.2.1.2 Implementer activity system

The implementer activity system is Concern Universal, a national non-governmental organisation. Concern Universal are among the pioneers in the dissemination of improved cook stoves in the country, they learnt the expertise in cook stove promotion and production from Programme for Biomass Energy Conservation-Deatsche Gesellschaft für International Zusammenabeit Malawi (ProBEC-GIZ). Balaka district was their first Chitetezo Mbaula implementation site. Concern Universal trained 15 groups in the production of Chitetezo Mbaula in 2009 under Nsamala Sustainable Energy Project, which promoted better access and use of energy with solar photovoltaics, tree planting and energy efficient cook stoves. When the project phased out in 2012, they started working under a project Developing Innovative Solutions with Communities to Overcome Vulnerability through Enhanced Resilience (DISCOVER). It is a consortium of eight organisations lead by Concern Universal (Concern Universal project coordinator personal communication, 2014). DISCOVER supports vulnerable communities in some districts in Malawi with climate change adaptation interventions. (Chapita Village is among beneficiaries of DISCOVER projects.). Additionally, Concern Universal is one of the implementer NGOs of the National Cook Stove programme. Concern Universal was the secretariat of the NCSSC. Between March 2013 and May 2014, the Project Manager of Concern Universal served as the Coordinator of the NCSSC. As an implementing

institution, Concern Universal faced some challenges. The major ones included lack of knowledge in rolling out cook stoves in communities when they started and the cracking of the stove on the upper door which is "a tendency to almost all groups" (Field Facilitator, Concern Universal, interview 14 May 2015) (Chisoni, 2015) producing Chitetezo Mbaula.

Figure 5.2 provides a short description of the activity system, which among other things, highlights the instruments, quality control poster and Controlled Cooking Tests (CCT), sensitisation meetings and the different activity systems. The main rules guiding the operations of the subjects of the activity system is the dissemination ICSs made of low-cost material for affordability by the rural population and production of good quality stoves to achieve high efficiency. The main outcomes are low firewood consumption and reduction of indoor air pollution.

Instruments: Quality control poster, Controlled cooking tests (CCT) (cooking demonstration), Theatre for Development, posters, Public address system, distribution of pigeon peas as an incentive , open days, road shows, DJ, calendars, t-shirts, sensitization meetings, market demonstrations, stove promoters, stove trainers, stove production groups

Object: Dissemination and promotion of low cost energy efficient portable cook stoves for convenient low energy cooking

Subject: Concern Universal Project Manager and Field Facilitators

Outcome: Income generation for stove production groups, low firewood consumption, reduce amount of time women spend in collection of firewood, allow regeneration of the remaining forest and reduce deforestation, reduction of smoke to reduce indoor air pollution, mitigating impacts of climate change, carbon trading

Rules: Disseminate cook stove made of low cost material for affordability by rural poor people, production groups should not sell cook stoves in order to facilitate production of good quality stoves to achieve high efficiency, destroy low quality stoves before firing, select quality stoves only for marketing, production groups should follow the quality control production cycle

Community: stove promoter, production group members, stove end-users, stove trainers, Village Head men, Department of Energy affairs- alternative energy section, NCSSC, funding agencies (DISCOVER project)

Division of labor: Stove promoter encourages producers to make stove, buys and sells stoves, encourages end-users to purchase stove, production group members produce stove, stove trainers train production groups to make stoves and fire them, builds a kiln, donors provide financial support, Field Facilitators conducting sensitization meetings and Controlled Cooking Tests, Overseeing quality of stoves Village Head men mobilize community for meetings

Figure 5.2: Implementer activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.2.1.3 Stove promoter activity system

The promoter activity system involves mainly one woman, sub-contracted by the implementers. She lives about 15 kilometres from the case study area. In 2009, Concern Universal organised a meeting in Group Village Mmanga at Naliswe Primary School and requested for volunteers who had Junior Certificate of Education and/ or Malawi School Certificate of Education to undergo some training for the implementation of Nsamala Sustainable Energy project (see Section 5.2.1.2). Eleven volunteers were trained and were involved in planting trees and teaching adults in basic literacy skills and numeracy, then later Concern Universal introduced the improved cook stove project. The volunteers were involved in stove promotion among other things, and were called stove promoters. By 2012, only one stove promoter of the eleven in

Group Village Headman Mmanga was left. The activity system hence mainly comprised of one promoter until 2015. Later in 2015, one of the members of the stove production group was trained as stove promoter. However, by the time I collected mirror data, she had not yet started her work as promoter. Later, the adult teaching component was phased out, leaving tree planting and stove promotion as roles for the stove promoter. Some of the problems, which the activity system faced, were the cracking of the stove on the upper door when they started selling stoves (see photo 6.1). The stoves were brought from Ntcheu. The second problem was transportation of the cook stoves from producers to buyers, as indicated earlier (see Section 5.2.1.1) The third problem was shortage of promoters, and therefore management of a large zone became problematic for one person, especially sensitising end-users about the stove (see Chapter 6, Section 6.3.3.2).

Figure 5.3 below presents a summary of the stove promoter activity system. It highlights among other things, the object of activity, which is buying and selling ICSs for convenient low-energy cooking, the bicycle for transportation as the main instrument and the rule guiding the operations of the subject is the selection of good quality ICS for marketing. In the division of labour, the stove promoter shares the roles with the implementers in sensitising end-users about the ICS.
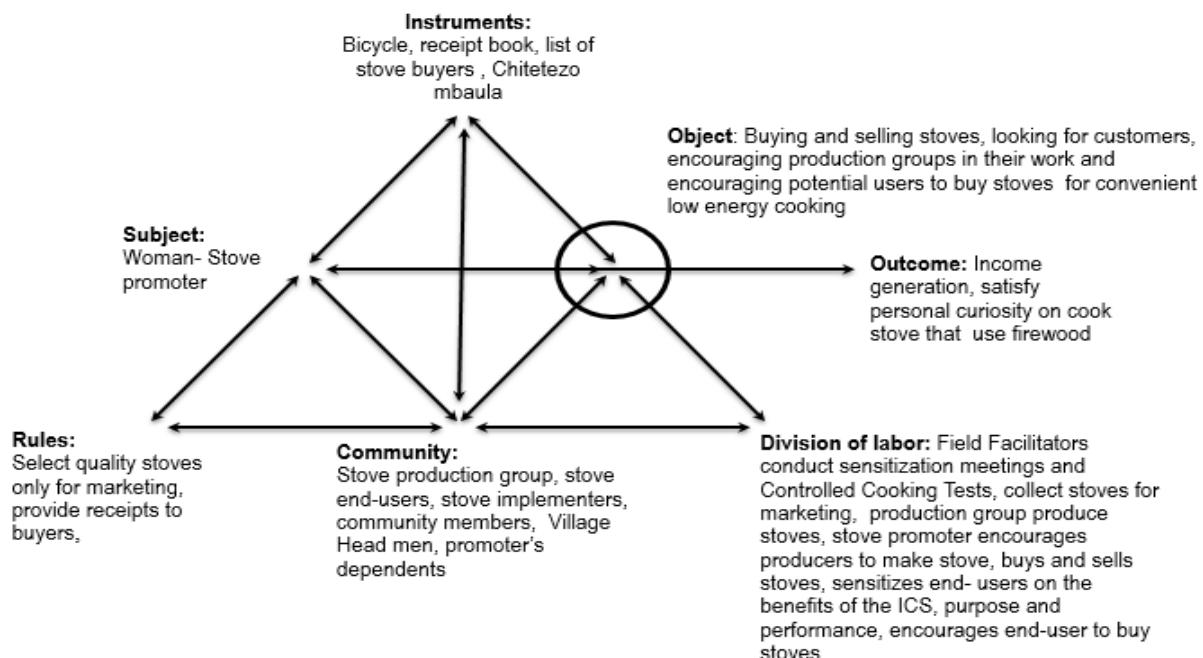
Figure 5.3: Stove promoter activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research (2003)

5.2.1.4 Stove trainer activity system

The trainer activity system is composed of one woman. She was among the first trainers in ICS production in Balaka. She received her training in ICS production in 2009 by ProBEC-GIZ together with Field

Facilitators from Concern Universal. In the same year, Concern Universal took her to Jana village, under Kuyitanda Group Village Headman in Balaka district to demonstrate the skills acquired through selecting and separating good from bad ICSs before firing them. At the end of the training, she was picked as one person with excellent skills in stove production and became a trainer. In 2010, Concern Universal asked her to demonstrate her skills again. This time she tested clay soil for stove production. Later in the same year, she was assigned to train Chapita Village production group, her first group to train. Some of the problems the activity system encountered included inconsistent attendance of production group members undergoing training, shortage of stove production moulds, which delayed production because members had to share moulds; cracking of the stove on the upper door at the end of the production process.

Figure 5.4 presents a summary of the trainer activity system. It highlights among other things, the object of activity in training stove producers in ICS production, with generation of good quality stoves as the outcome. In addition, the main rule governing the operations of the stove trainer is to test the clay soil for ICS production.

Instruments:
Stove construction tools and materials, kiln construction materials (stones, bricks, quarry stones, sand, shelter, kiln for firing, firewood for stove firing, house for keeping wet and dried stoves, group of women and men

Object: Training groups in stove production and firing for convenient low energy cooking

Subject: Woman- ICS trainer

Outcome: quality stoves, income generation

Rules: clay soil from a production site should be tested before training the groups to produce stoves, introduce the tools and materials and their functions before practical lesson, stoves should be fired only in a kiln, all measurements and quality control production process should be followed

Community: Production group, stove implementers (Field Facilitators)

Division of labor: Producers learn to make stoves, and firing, trainer teaches the women and men to make stoves and fire them, Field Facilitator oversees the work of trainer

Figure 5.4: Stove trainer activity System
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.2.1.5 Stove production activity system

In 2009, Concern Universal brought cook stoves from Ntcheu district and sold them in Chapita Village. However, a group of people felt that they could make their own stoves instead of receiving stoves from elsewhere. They organised themselves and approached the stove promoter to assist them in establishing a production group. In 2010, the group was established with the help of the promoter and the Field

Facilitator from Concern Universal with eighteen members, comprising two men and sixteen women. Members received training from a stove trainer subcontracted by Concern Universal. The group was among the first groups to be trained in stove production by Concern Universal with expertise from ProBEC-GIZ. Chapita Village is one of the oldest sites to produce Chitetezo Mbaula in Balaka. On 5 June 2010, after undergoing the training, they produced the first cycle of stoves, then a month later the group was trained in stove firing. Some of the major problems the group faced was dropping out of members, from eighteen in 2009 to three in 2014. By 2014, only one member, the chairperson of the group was producing stoves. In 2015, only one member was left (see Chapter 7, Table 7.1). This was due to the nature of work involved, which is hard and labour intensive (see Chapter 6, Section 6.3.2.5).

Mid-way into stove production, the group split due to distance to the production centre and because most members near the production centre had stopped producing stoves. As a result, a few members started producing as individuals, but later failed to continue. The second problem was to do with tools, the group had no shelter for keeping and drying stoves; they were using a house belonging to one member, however, some privacy issues arose, and the group was no longer allowed to keep the stoves in the house. The third problem was the cracking of the stove on the upper door (see Chapter 6, Section 6.3.2.1). One remarkable change that occurred in the course of stove production was the transition from using a bucket mould to pedal mould. This was done to incorporate the hottest point from the flame, which is between 18-23cm, since the bucket mould was shorter. However, the group experienced problems with both moulds in terms of injuries sustained to the hands from pounding the clay into the mould (see Chapter 6, Section 6.3.2.5). The pedal mould also leaves a hole at the centre of stoves, which needs to seal properly, or it becomes a weak point of the stove. This was causing some of the stoves produced by the group to break quickly at the bottom.

Figure 5.5 presents a summary of the stove production activity system. Among other things, it highlights the object of the activity system, which is to produce good quality ICSs, and the main outcome as making a livelihood. The rules governing the operations of subjects are to desist from selling ICSs in order to concentrate on production of quality ICSs. The instruments include raw materials and tools for stove production and a house for keeping the ICSs.

Instruments: All raw materials for stove construction (clay soil, water, firewood for firing stoves); Instruments for molding the stove (bucket and peddle mold, measuring tools, human hands and feet for mixing cob, plastic paper or fired brick dust); kiln, house for keeping wet and dried stoves, fermentation pit for clay soil, hoes for digging clay soil, , molds for pot rests and handles

Object: Production of quality energy efficient cook stoves for convenient low energy cooking

Subject: Women group

Outcome: to make a livelihood (income generation), to be financially independent as a woman, protect remaining forest to address climate variability impacts especially changes in rain patterns and erratic rains

Rules: Follow quality control production process to produce quality stoves, producers should not be involved in selling stoves in order to concentrate on production of quality stoves, Norm: producers should abstain from sex when firing stoves

Community: Stove end-users, Field Facilitators from Concern Universal, stove trainers, stove promoter, village head men, dependents of production group members

Division of labor: Production group executive committee members (Chairlady, treasurer, secretary); stove promoter encourages producers to make stove, buys and sells stoves, stove production group members collect clay and dig pit for soil fermentation together, make stoves as individuals, Field Facilitators oversee quality of stoves

Figure 5.5: Stove production activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.2.1.6 Stove end-users activity systems

The three end-user activity systems have similar objects; in this regard, they form one end-user activity system. According to Kaptelinin (2005),

> objects of activities are dynamically constructed on the basis of various types of constraints, which include the needs that the activity at hand is striving to satisfy, available means, other potentially related activities, and other actors involved… (p. 17)

The end-users in the three case studies are working on the same problem space, striving to achieve *convenient low energy cooking* with the available types of cook stoves the TSF and the ICS, in the context of firewood scarcity, increased deforestation and climate change mitigation and adaptation strategies. The activity systems are separated because of the ways in which the subjects interact with their object. This difference is shown in the description of the subject in the three categories in all three case studies.

The categories of the activity system include: (1) Improved Cook Stove (ICS) user activity system, whose subjects used the ICS exclusively. It was the smallest of the end-user activity systems in terms of number of its members within the study area. (2) Three Stone Fire and Improved Cook Stove (TSF & ICS) user activity system whose subjects used both the ICS and TSF. The subjects ranged from those who have used the ICS once and abandoned it, to those who sparingly used the ICS, such as twice in a week, and used TSF every day, to those who switched between ICS and TSF depending on the type of dish they are cooking, or the number of dishes they are cooking at that time. This was the largest of the end-user activity systems within the study area. (3) Three Stone Fire (TSF) user activity system whose subjects had never bought a stove and used TSF exclusively. Hence, the TSF and ICS user activity system and

the TSF user activity system are transitioning activity systems from the TSF to the ICS. This applies to all three case studies.

The end-user activity system started in 2009 when the stove promoter sensitised the community about the improved cook stove that Concern Universal was planning to bring and sell to the community members as indicated earlier (see Section 5.2.1.5). During that time, community members became aware of the benefits of the cook stove as explained by the stove promoter and pledged to purchase the stove. They paid the money upfront because of the need to save firewood (see Chapter 4, Section 4.3.1.1). This was the first group to adopt the ICS in Chapita village. The problems experienced within the first few days of using the stove were the cracks on the upper door of the stove. Further, according to the stove promoter, some stoves disintegrated. A second group bought stoves in 2010 when the production group in Chapita village produced the first cycle of stoves. The third group purchased stoves between 2011 and 2014. However, some members had not purchased the stove, by the time I collected mirror data in May 2015. These are subjects of the TSF user activity system.

Figures 5.6, 5.7 and 5.8 provide summaries of the three activity systems, which among other things, show a common object of activity that highlight the need for convenience (see Chapter 1, Section 1.7.4). The main common outcome is to achieve speed in cooking. In addition, the subjects are described according to their interaction with their objects of activity.
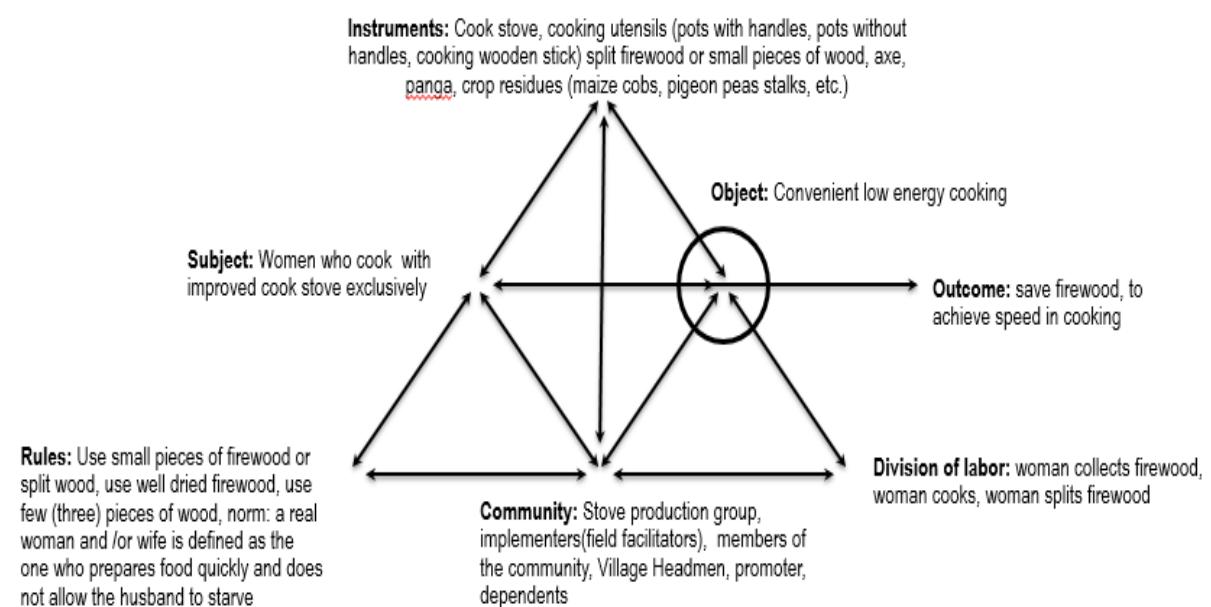
Figure 5.6: Improved Cook Stove user activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

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Instruments: Cook stove, Three stone fire, cooking utensils
(pots with handles, pots without handles, cooking wooden stick),
split firewood or small pieces of wood, axe, panga knife crop
residues (maize cobs, pigeon peas stalks, etc.)

Subject: Women who cook on three stone fire (TSF)
everyday and seldom on cook stove (ICS); Women who
cooked with ICS, but abandoned it; Women who switch
between the TSF and ICS depending on what dish they
are cooking, or the number of dishes the are cooking;
women who cook on both TSF & ICS

Object: Convenient low energy cooking

Outcome: save firewood, to achieve
speed in cooking, to save trees

Rules: Use small pieces of firewood or split
wood, use well dried firewood, use few (three)
pieces of wood, norm: a real woman and /or
wife is defined as the one who prepares food
quickly and does not allow the husband to
starve

Community: Stove production
group, implementers (field
facilitators), members of the
community, Village Headmen,
promoter , dependents

Division of labor: woman collects firewood,
woman cooks, woman split firewood

Figure 5.7 Three Stone Fire and Improved Cook Stove user activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

Instruments: Three stone fire, cooking
utensils, firewood, crop residues
(maize cobs, pigeon peas stalks, etc.)

Subject: Women who have never had a
cook stove, they cook with three stone
fire everyday

Object: Convenient low energy cooking

Outcome: To prepare well
cooked food, to achieve
speed in cooking

Rules: Norm: a real woman and
/or wife is defined as the one
who prepares food quickly and
does not allow the husband to
starve

Community: stove production group,
promoter, implementers (field
facilitators), members of the
community (women who have stoves,
etc.), dependents, Village Head men

Division of labor:
Woman collects fire wood, woman cooks

Figure 5.8: Three Stone Fire user activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

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5.2.2 Activity systems in Waziloya Makwakwa Village case study

I identified four activity systems in Waziloya Village Case study, including implementer activity system, stove construction activity system, improved cook stove (ICS) user activity system and three stone fire (TSF) user activity system, as discussed below.

5.2.2.1 Implementer activity system

The Catholic Development Commission in Malawi (CADECOM) under Mzuzu Diocese started implementing the fixed cook stove in the study area in October 2013, under their Integrated Community Development project, which has three components, food security, water and sanitation and natural resource management. The promotion of ICS falls under the natural resource management component. The Integrated Community Development project focusses on crossing-cutting issues including HIV and AIDS, child protection and gender. The fixed stove disseminated in this area was brought from Uganda when some members from the organisation under Mangochi Diocese visited. In 2012, CADECOM Mzuzu Diocese visited Balaka, Utale 1 parish to learn the technology to prepare for implementation in the study area.

Some of the challenges faced were delayed funding which affected the starting of project activities with three months, lack of availability of "standard" kitchens (see Chapter 6, Sections 6.4.1.1 and 6.4.1.2) in the community which delayed construction of cook stoves and lack of cattle kraals in the area. Some of the notable changes include construction of the stove against the wall to accommodate a chimney. The first model was constructed in the centre; however, it was producing a lot of smoke. They also added some construction materials including cow dung and *ndhulani* because the first model was cracking and it had a short life span. The project was phased out in June 2016 soon after carrying out follow up sessions to the BCCLWs.

Figure 5.9 shows a summary of the implementer activity system, which among other things, highlights the strength-based approach and volunteer clubs as the main instruments, the rule to build ICS only in a standard kitchen and the outcome to disseminate 450 ICSs in three years.
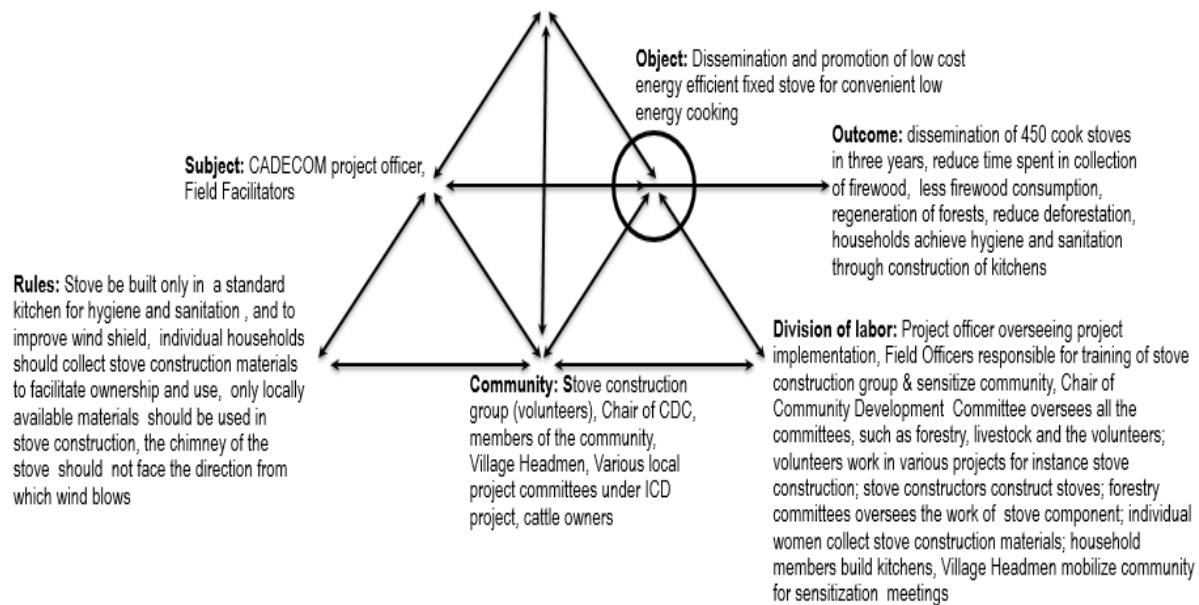
Figure 5.9: Implementer activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.2.2.2 Stove construction activity system

The construction group started in 2013 with the coming of CADECOM. CADECOM Field Facilitators trained them in stove construction, and three months later, they visited Tchesamo area to learn the practical part of stove construction where CADECOM had implemented a similar project. Stove construction activities started between December 2013 and January 2014 due to delays that occurred, because members were sourcing money to learn stove construction at Tchesamo. Some of the major challenges in the activity included dropping out of members from the clubs. When they started each group had about 20 members, however, at the time I collected data some groups had between five and nine people, which resulted in pressure on the few members remaining. A related challenge experienced was lack of leadership in the construction group, which affected organisation of stove construction activities and sourcing of food when constructing stoves (see Chapter, Section 6.4.4.1).

Figure 5.10 provides a summary of the activity system, which among other things highlights *ndhulani* and cow dung as instruments, the rule not to charge stove construction and a group of women and men volunteers as subjects of the activity system.

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Instruments: All materials for stove construction (banana trunk, water, ndhulani, cow dung, sand, clay soil from anthill, grass, piece of thread for measurement, sharpened piece of wood for holding banana trunk in one position, hoes, human feet and hands for mixing cob, bucket for measuring, panga, pestles for breaking soil, pots for measuring space between cooking places,

Object: Construction of low cost energy efficient fixed stove for convenient low energy cooking

Subject: Group of women and men volunteers

Outcome: To use less firewood for cooking reduce firewood collection trips, save forests

Rules: No cost should be charged for constructing stoves, stove should only be constructed in a 'standard' kitchen, chimney should not face in the direction from which wind blows, TSF users should collect stove construction materials alone to encourage ownership and use, stove construction process should be followed, including quantities for materials, all measurements, and number of days for awaiting stove opening

Community: TSF users, implementing institution, Village Headmen, community members, Chair CDC

Division of labor: TSF users construct kitchen, collect stove construction materials and invite stove construction members; construction group constructs stoves, experts in construction are in the kitchen when making the stove, the rest are outside passing the cob on a line, Field Facilitators train construction group in stove construction

Figure 5.10: Stove construction activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.2.2.3 Stove end-users activity systems

There are three categories of end-users in this case study including: (1) Improved Cook Stove (ICS) user activity system comprised of subjects who cook on the ICS exclusively. This was the second smallest activity system of the three in terms of number of its subjects as stove uptake was a challenge as discussed earlier in Chapter 4. (2) TSF user activity system was the largest. The activity system comprised of subjects who cook on the TSF exclusively. Some members expressed knowledge about the cook stove and its benefits, and indicated that they admired the stove; however they were constrained by some of the contradictions identified (see Chapter 6). Another group of subjects had very little knowledge about the stove; these subjects did not express any interest in the stove. Yet some of them had kitchens, which was one of the requirements for construction of a stove as indicated earlier. I grouped them together since they were all using TSF exclusively. (3) The TSF & ICS user comprised a subject who uses the ICS most of the time, and sometimes uses TSF in combination with ICS. This was the smallest activity system in terms of number of members as only one person was involved.

The end-user activity started in 2013 with the coming of CADECOM to the study site. A sensitisation meeting was organised for the entire community. Field Facilitators sensitised the community on all the components of the ICD project during the meeting. However, the first group started cooking on the stoves in 2014, since they were waiting for the stove construction group to be trained. After the first group constructed stoves, others started experiencing scarcity of stove construction materials (Chisoni, 2016a), (see also Chapter 4, Section 4.3.2.2.) This comprised those who were cooking on TSF.

Figures 5.11, 5.12 and 5.13 provide summaries of the three activity systems, which among other things, show a common object of activity, which is convenient low energy cooking, almost similar outcomes that highlight the need for saving time during the cooking activity. However, the TSF user activity system highlights the rule of 'no standard kitchen no stove' (see Chapter 6, Sections 6.4.1.1 and 6.4.1.2) that no longer applies to the other two activity systems because they passed that stage in their transition to ICS technology. In addition, the subjects act on their objects in different ways.
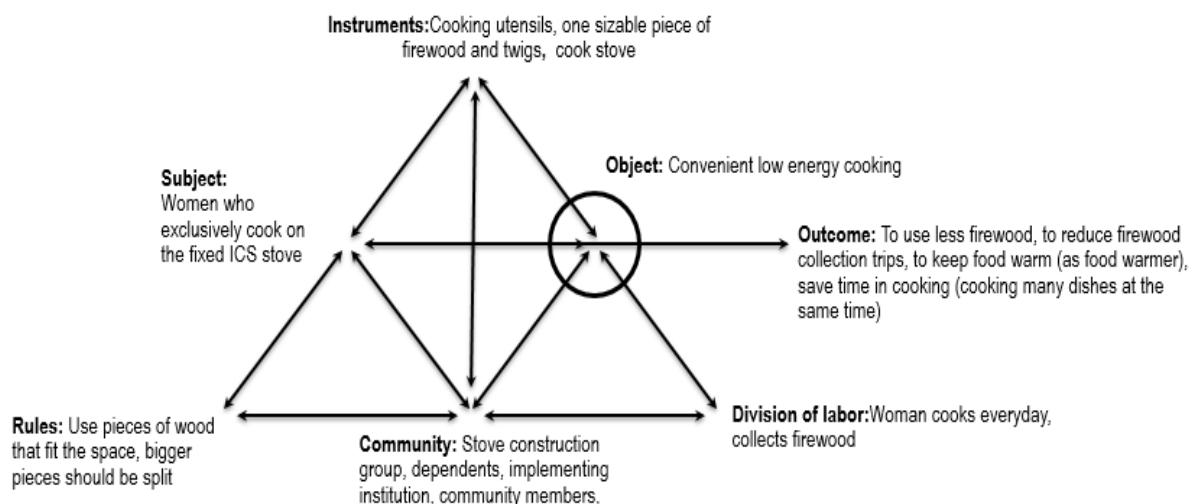
Figure 5.11: Improved Cook Stove user activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003
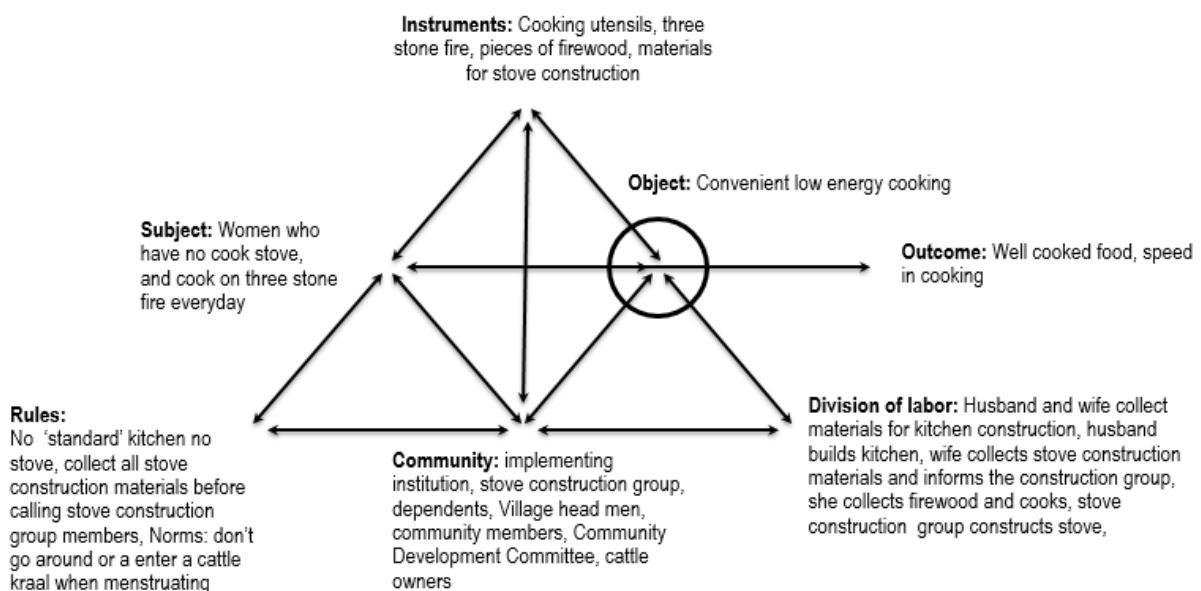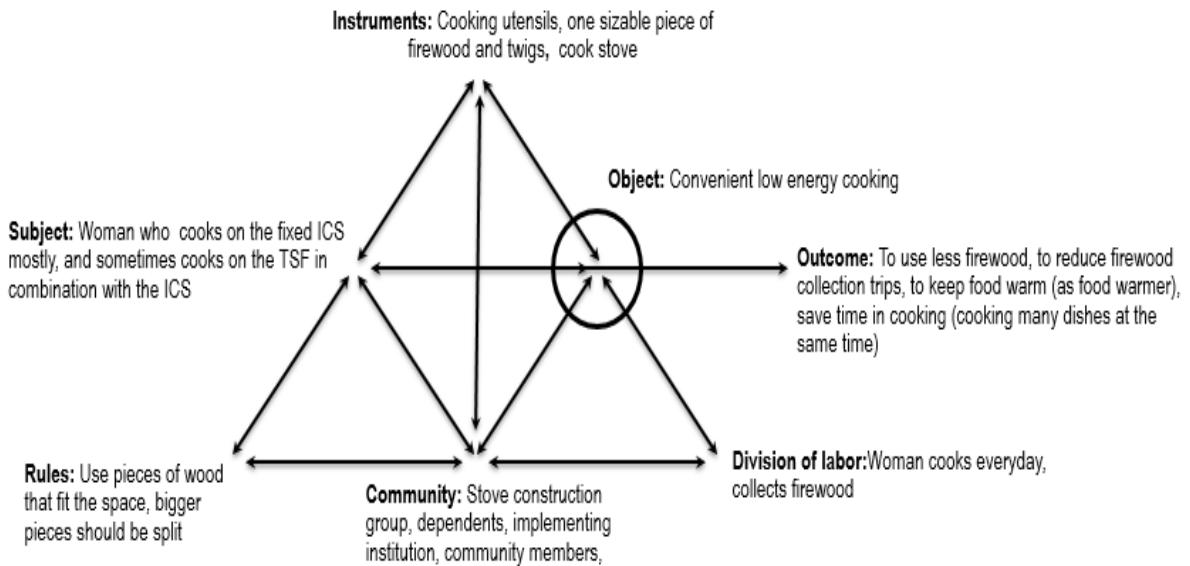
Figure 5.12: Three Stone Fire user activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

Instruments: Cooking utensils, one sizable piece of firewood and twigs, cook stove

Object: Convenient low energy cooking

Subject: Woman who cooks on the fixed ICS mostly, and sometimes cooks on the TSF in combination with the ICS

Outcome: To use less firewood, to reduce firewood collection trips, to keep food warm (as food warmer), save time in cooking (cooking many dishes at the same time)

Rules: Use pieces of wood that fit the space, bigger pieces should be split

Community: Stove construction group, dependents, implementing institution, community members,

Division of labor: Woman cooks everyday, collects firewood

Figure 5.13: Three Stone Fire and Improved Cook Stove user activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.2.3 Activity systems in Chilije Village case study

In this case study, I identified eight activity systems including the ICS user activity system, the TSF & ICS user activity system, TSF user activity system, the implementer activity system, the stove production activity system, the promoter activity system, the trainer activity system, and policy activity system. However, data was collected from six activity systems, excluding the promoter and the trainer activity systems as indicated in Chapter 3, Section 3.5.5.3. According to the Field Facilitators representing the implementer activity system, the promoter was not active during the running of the project. The major problem I encountered with this case study was that the Field Facilitator who was responsible for the implementation of the project in this area was transferred to another district and the one who took over had visited the project area once in the previous year. The project manager had moved to another district. Additionally, the project was phasing out by the time I collected mirror data. The production group was defunct because of marketing problems and misappropriation of funds from stove sales. They had stopped making stoves for two years by the time I collected data. Due to this situation, it was difficult to get hold of the trainer and the promoter. However, the activity systems for the promoter and trainer are similar to the Chapita Village case study in almost all the elements, except for the outcome, since subjects of an activity seem to have different reasons for engaging in an activity. Since information was not collected on the two activity systems, I have included only the activity systems that took part in the study. Furthermore, the policy activity system in this case is the same as for Chapita Village case study. Due to this, I will not repeat the description of the activity system under this section.

5.2.3.1 Implementer activity system

Concern Universal implemented the cook stove project in Chilije Village in April 2011 under Nsamala Sustainable Energy Project. They formed and trained a stove production group and worked with them up to October 2013 when the project phased out. Another project, Local Development Support Programme (LDSP) took over to continue the cook stove project after a long period. However, the project phased out in June 2015. Some of the major challenges they faced during the implementation of the project was working with a stove promoter who was not active, they also experienced low rate of stove adoption and use of the stove was problematic, which the Field Facilitators attributed to the availability of firewood because the area is near Dzalanyama Forest Reserve (see Chapter 1).

Figure 5.14 provides a summary of the activity system. It highlights among other things, the role of Village Chiefs in mobilising communities to purchase the ICS through issuing commands and punishing those who do not obey the commands. Similar to implementer activity system in Chapita case study (see Figure 5.2), it highlights the rules to ensure production of good quality ICSs, the CCTs and sensitisation meetings as the main instruments.
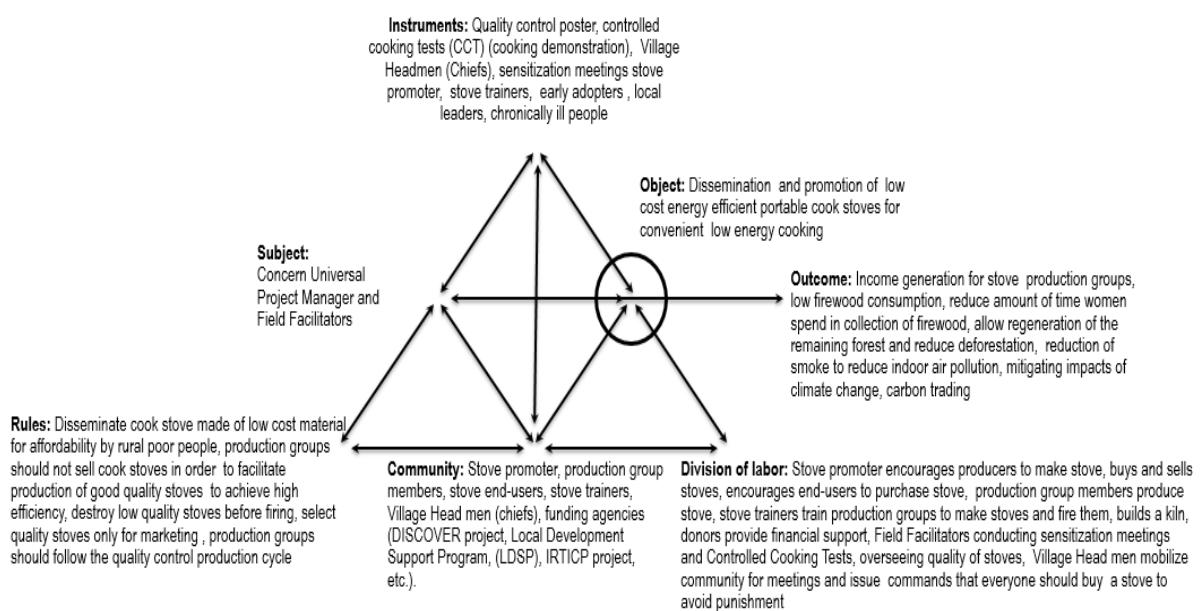

Figure 5.14: Implementer activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.2.3.2 Stove production activity system
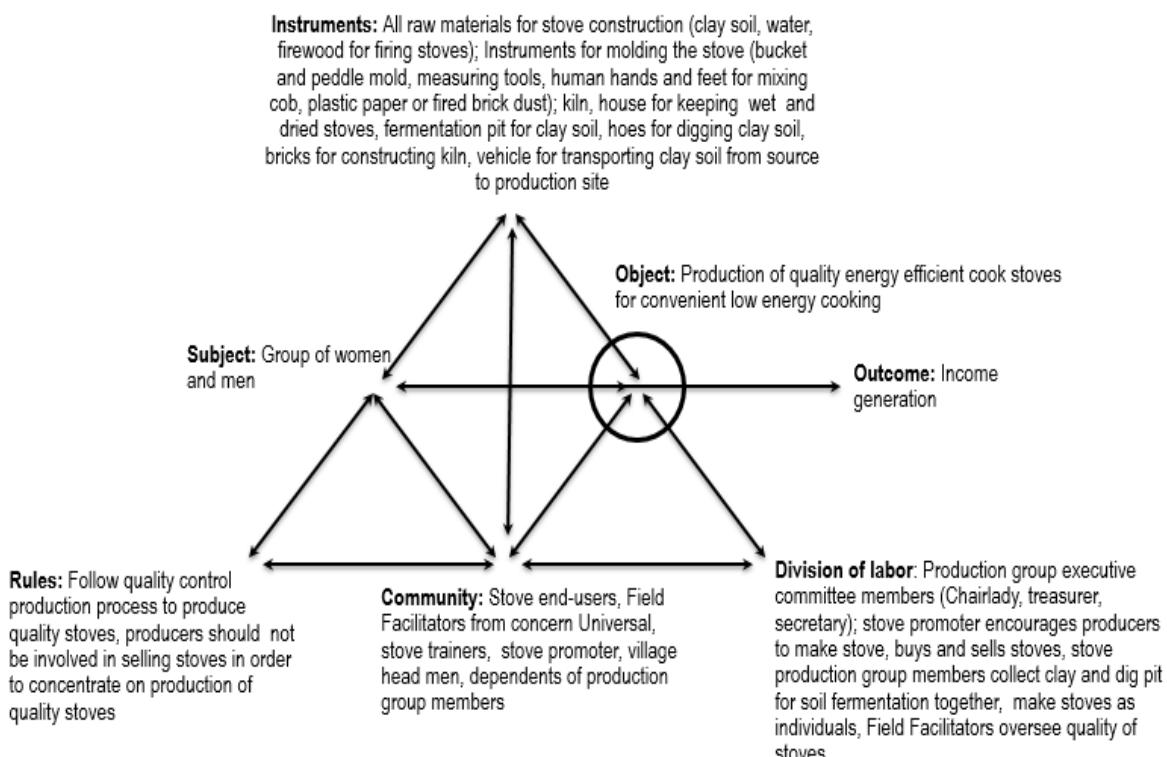
The stove production activity system started in 2011 when the group was trained in stove production. Some of the major problems experienced include unavailability of suitable clay soil for production. The group had difficulties to find suitable clay in nearby places; later they found the right clay source at a distance of seven kilometres from the production site. This created transportation problems; they had to

pay a vehicle to transport the clay. Another problem was marketing of stoves. Due to their remoteness (see Chapter 1), they relied on transportation provided by Concern Universal which was not reliable (see Chapter 6, Section 6.5.2.3). This resulted in stock piling of stoves since the villages around had reached saturation point. As a result, they had no storage space and most of the stoves were damaged (see Photo 5.1). In addition, the group never received the proceeds from the stove sales since they started production in 2011 until the time I collected mirror data in May 2015 (see Chapter 6, Section 6.5.3.1).

Photo 5.1: Damaged ICSs on open ground and few stoves stored in a house (Chisoni, May 2015)

Figure 5.15 provides a summary of the activity system, which highlights among other things, the subjects that include women and men, the rules to ensure production of good quality ICSs and role of the Field facilitator to oversee production of quality ICSs.

*Figure 5.15: Stove production activity system*
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.2.3.3 Stove end-users activity systems

There were also three categories of stove end-users activity systems: The Improved Cook stove (ICS) user activity system, the three stone fire (TSF) and improved cook stove (ICS) user activity system and the three stone fire (TSF) user activity system. The activity system categorisation is similar to the one described in Section 5.2.1.6. In the same way, the largest of the activity systems was the TSF and ICS user activity system.

In this case study, the stove end-users activity system started towards the end of 2011. Another group purchased stoves in 2012. However, some had not purchased a stove by the time I collected data in June 2015.

Figures 5.16, 5.17 and 5.18 provide summaries of the three end-user activity systems. Among other things, the activity systems highlight a common object of activity. While the two transitioning activity systems (TSF and TSF and ICS end-user) share the outcome, which is to achieve speed during cooking, the ICS end-user activity system highlights the portability of the ICS as the main outcome. In addition, the three activity systems highlight a rule (norm) concerning the way 'a real woman' is defined in relation to food preparation.

Instruments:
Cook stove, cooking utensils (pots with handles, pots without handles, cooking wooden stick) split firewood or small pieces of wood, axe, panga, crop residues (maize cobs, twigs.)

Object: Convenient low energy cooking

Subject: Women who cook with improved cook stove exclusively

Outcome: easy shifting, to use many kinds of fuel (crop residues, litter or twigs)

Rules: Use small pieces of firewood or split wood, use well dried firewood, use few (three) pieces of wood, norm: a real woman and /or wife is defined as the one who prepares food quickly and does not allow the husband to starve

Community: Stove production group, implementing institution, members of the community, Village Headmen, promoter, dependents

Division of labor: woman collects firewood, woman cooks, woman splits firewood

Figure 5.16: Improved Cook Stove user activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

Instruments: Cook stove, Three stone fire, cooking utensils (pots with handles, pots without handles, cooking wooden stick), split firewood or small pieces of wood, axe, panga knife crop residues (maize cobs, pigeon peas stalks, etc.)

Object: Convenient low energy cooking

Outcome: speed up cooking

Subject: Women who cook on three stone fire (TSF) everyday and seldom on cook stove (ICS); Women who cooked with ICS, but abandoned it; Women who switch between the TSF and ICS depending on what dish they are cooking, or the number of dishes the are cooking; women who cook on both TSF & ICS

Rules: Use small pieces of firewood or split wood, use well dried firewood, use few (three) pieces of wood, norm: a real woman and /or wife is defined as the one who prepares food quickly and does not allow the husband to starve

Community: Stove production group, implementing institution, members of the community, Village Headmen, promoter, dependents

Division of labor: woman collects firewood, woman cooks, woman splits firewood

Figure 5.17: Three Stone Fire & Improved Cook Stove user activity
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

Instruments: Three stone fire, cooking utensils, firewood, crop residues (maize cobs, pigeon peas stalks, etc.

Object: Convenient low energy cooking

Outcome: speed in cooking, well cooked food

Subject: Women or men who have never had a cook stove, they cook with three stone fire everyday

Rules: Norm: a real woman and /or wife is defined as the one who prepares food quickly and does not allow the husband to starve

Community: stove production group, promoter, implementing institution, members of the community (women who have stoves, etc.), dependents, Village Head men

Division of labor: Woman collects fire wood, woman cooks

Figure 5.18: Three Stone Fire user activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

5.3 Learning interactions among Improved Cook Stove actors

5.3.1 Learning interactions in the three case studies

In order to determine the learning taking place during interactions, I identified the subject of the learning (who is learning?) and the content of the learning (what do they learn?) during the interactions (Engeström, 2009), as indicated earlier. In section 5.4, I will discuss key actions of the processes of learning, or in other words, how the actors learn (ibid.). In some cases, I found that subjects indicated

both what they learn and how they learn within the same citations, and it was not possible to isolate these and present coherent citations. In that case, a cross reference will be used wherever necessary. Despite evidence of interactions and learning interactions, there are instances of tenuous interactions, which I present in Section 5.5 (see also more evidence of tenuous interaction in Chapter 6, Sections 6.3.3.1 and 6.3.4.1).

5.3.1.1 Learning interactions in Chapita Village case study

In Chapita village case study, I identified learning interactions between subjects within activity systems and those between subjects of the different activity systems. I will first discuss the learning interactions between subjects of the same activity systems, and then the learning taking place between subjects of the different activity systems.

- **Learning interactions between actors within activity systems**

Subjects of the stove producer, implementer and end-user activity systems learn from each other within their activity systems. However, the implementers learnt from other stove implementers outside their institution, who were the first pioneers in stove production (see Chapter 1, Section 1.7.1.3).

Stove producers learn from fellow stove producers: During a group interview with stove production group members, I found that members were learning from each other to perfect their skills in stove production:

> ***Stove producer 1:*** *When a colleague made mistakes […] we were explaining to them […] and showed them how to do it. […] We were listening to whatever our colleagues would say, and followed so that we should produce a quality stove, which should not be difficult to sell when it goes on the market.* (Interview # BK10)

End-users learn from end-users: End-users learn from other end-users, despite that it was not much evident from the data. The ICS user below explained that she learnt about the fire saving characteristic of the ICS from those who own a stove and this encouraged her to purchase the stove:

> ***Researcher:*** *How did you know and learn about the stove?*
>
> ***ICS user FJ:*** *I have never learnt about the stove.* (Interview # BK7).
>
> ***Researcher:*** *So how did you decide to buy the stove?*
>
> ***ICS user FJ:*** *I just heard from the people who bought the stove that the stove and the three stone fires are different, that the stove is good, you can save firewood compared to three stone fire.* (Interview # BK7)

Implementers learn from other implementers: Concern Universal Field Facilitator revealed that he learnt about the ICS from GIZ who offered them some training as discussed earlier. GIZ were among the

pioneers in stove production and dissemination in Malawi (see Chapter 1, Section 1.4.4.2). The excerpt below provides evidence of the learning:

> **Field Facilitator LM:** *It was about what an improved cook stove is. Its importance, how to mould a stove, and about quality control tools. Yea and mobilisation - how the stoves can be rolled out to communities. … The training was organised by the project (Nsamala Sustainable Energy Project) but we sought expertise of those people from GIZ.* (Interview # BK11)

In the citation above, the Field Facilitator indicated that the content of the learning included understanding an ICS, its benefits, moulding an ICS, quality control tools and how to disseminate stoves in communities. The kind of learning described here falls under training (see Section 5.4.1).

- **Existing learning interactions among actors between activity systems and the content of learning during interactions**

In order to discuss the learning interactions between subjects of the activity systems, I started by showing the interactions happening between them, in order to show the lines of interaction. Figure 5.19 below, shows existing interactions between different actors. However, not all the interactions happening are learning interactions. In order to differentiate this; I have used dotted lines to indicate interaction and solid arrows to indicate learning interactions. For example, the policy makers interact with the implementers; however, there was no learning interaction identified in the data using the criteria described by (Engeström, 2009) as indicated earlier. It appeared that no learning was taking place between the implementers and the policy makers, within the bounds of the case study and from the data collected. The connected cycles within the triangles indicate learning interaction between subjects of an activity system. The arrows identify the learning subject in each interaction.
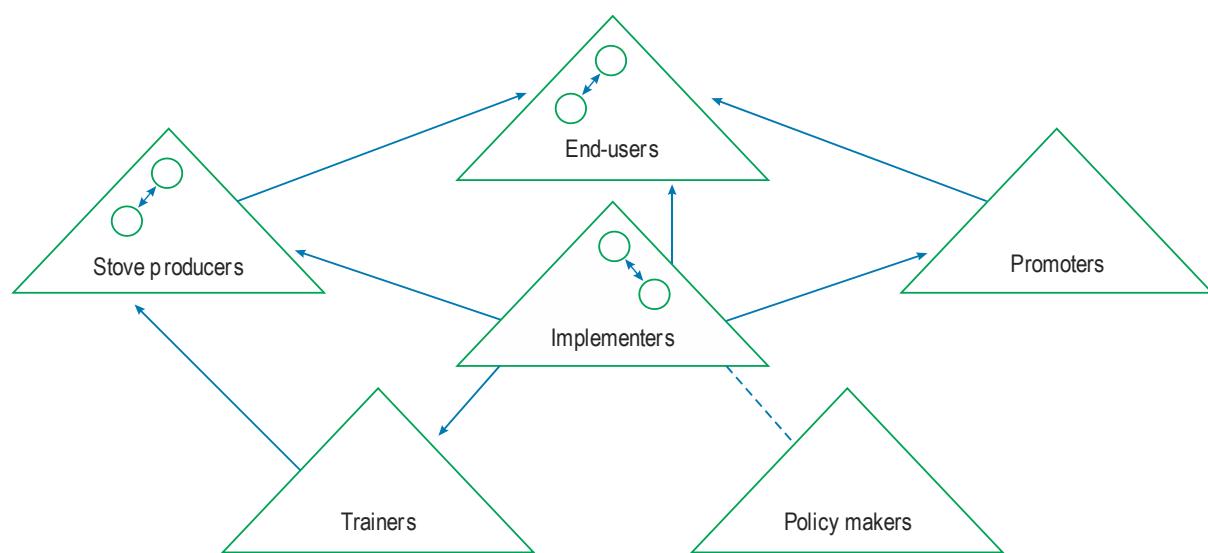
Figure 5.19: Existing interactions and learning interactions among cook stove actors in Chapita Village case study

Source: Jalasi, 2018

Learning interaction between end-users and stove promoters and the content of learning: I identified evidence of learning interaction between end-users and stove promoters in the following excerpts:

> *TSF & ICS user MB: The one who facilitates stove promotion here is a certain woman (the promoter) who stays across (the river).* (Interview # BK8)

> *Field Facilitator LM: Our […] model was (is) to involve stove promoters that actually live in the communities. […] Promoters are the ones that go around the communities and inform or tell communities the importance of such stoves.* (Interview # BK11)

The promoter substantiated the interaction between the end-users and her. She indicated that she is responsible for encouraging end-users to buy stoves:

> *Stove promoter SB: I am the one because this is my responsibility. I encourage the women to buy stoves, maybe when there is a community meeting; I use that opportunity to encourage the women to buy stoves. … I encourage them by telling them the benefits they can get when they use the stove. I tell them these are the benefits of using the stove.* (Interview # BK1)

The interaction was also evidenced from a group interview that I held with stove production group members:

> *Stove producer 1: Before we started the production group, a meeting was held at the Chief in the village and the stove promoter explained that she had received a message that we will be receiving stoves in the village and people should buy … So they were explaining the benefits of the stoves, that the stoves uses firewood as type of fuel and they save firewood so that the forests should regenerate in our area because the forests have diminished and we are receiving low rainfall. However, if we would be using the stoves forests would regenerate. We are also inhaling bad air. However, when forests regenerate we would be inhaling fresh air because when we breathe out our bad air, trees will be doing better. The bad air released by the trees is good for us.* (Interview # BK10)

In the excerpts above, end-users learn the benefits of the stove, especially in relation to addressing deforestation by allowing forests to regenerate and how forests and trees can help in keeping an environment safe. They also learn how diminishing of forests is linked to low rainfall received in the area and /or climate variability. The citations also provide details on how the learning is happening through community meetings.

Learning interactions between end-users and stove producers and the content of learning: In Chapita village, I found that most end-users knew and learnt about the stove from stove producers. This usually happened when the producers advertised the stoves or when end-users bought stoves. This was also evident in Chilije village case study (see section 5.3.1.3), yet it was not evident in Waziloya Makwakwa village case study. The advertisement was through casual meetings, for instance, when they met at a borehole. In some instances end-users spot the stoves at a production group member (see Section 5.4.5). Further, in some instances the selling-buying transaction was accompanied with information mainly on the firewood-saving characteristic of the stove and how this in turn may protect the

remaining forests. However, in some cases, no information was provided; see, for example, citation from *TSF & ICS user FK* below. There were few instances where handling of the stove was discussed. The exchange of information also depended on whether the buyer asked questions. The excerpts below provide evidence of the interaction and the content of the learning:

> *Researcher: Since you came in this village, have you ever heard anything about stoves?*

> *TSF user RA: I heard it from the woman you were with yesterday (producer) … and another woman (mentions name) there (pointing to the direction), they make stoves and sell them. That is when I knew about the stoves. … What I heard about the stoves is that it does not consume a lot of firewood when you cook. They say may be you can use few pieces of firewood the whole day. … after making the stoves, people go there to buy. … They say that we should buy the stoves because these days the forest is diminishing, so you can find few pieces of firewood but you can use to cook many dishes.* (Interview # BK9)

> *TSF & ICS user MB: I knew about the stove from a certain woman in that house she produces stoves that is where I bought my stove.* (Interview # BK8)

> *TSF & ICS user ZJ: Since I am near them, she told me that she has produced stoves and if I would be interested, I can go and buy. … I learnt that a stove is a good thing because it saves firewood, as a result the environment is saved … she told me when I was buying the stove, that the stove is good that it saves firewood.* (Interview # BK1)

> *TSF & ICS user FK: When the producers make the stoves, they tell you that they have made the stoves that is how we know about the stove. … They just tell you I have stoves but there is not any specific message they tell you.* (Interview # BK5)

> *Researcher: Are there any instructions that you were given that you know, and how did you know the instructions concerning handling of the stove?*

> *TSF & ICS user FK: They just told us that we need to look after the stove carefully, we should not put it outside and we should not leave children to play with it because it is made of soil it needs care and that we should not use it for washing clothes.* (Interview # BK5)

> *Researcher: Who told you that?*

> *TSF & ICS user FK: Where I bought the stove.* (Interview # BK5)

The information provided by stove producers substantiate explanations end-users provided:

> *Researcher: So how do you interact with the potential stove users? Do you organise meetings, or how do you meet them?*

> *Producer 1: We have never had any meetings with the potential stove users. We disseminate the messages whenever we find opportunity, whether it is at the borehole, or when we have visited another village. We tell who ever we meet – you said you wanted stoves, we have produced the stoves and they are ready. So, those who are willing they come to buy.* (Interview # BK10)

> *Producer 2: What we discuss when we meet them is to encourage them about the stove. […] We tell them … that they will reduce the amount of firewood and that their cooking will be going well when they cook on the stove … and that they have advanced their homes, and that the important thing is to protect trees.* (Interview # BK10)

> *Producer 1: End-users do not like charcoal to remain in the stove when they are cooking, but we tell them that it is not a problem, it is even good as it keeps the heat, that even when you have finished cooking something, the heat can help to warm another thing.* (Interview # BK10)

In the above excerpts, the additional content relates to the heat retention characteristic of the stove and clarifying a problematic issue that end-users experience when they cook on the stove.

Learning interactions between end-users and implementers and the content of learning: There were few instances from data that end-users reported learning about the cook stove from implementers. This is because there seemed to be tenuous interaction between implementers and end-users (see Section 5.5.1, and Chapter 6, Sections 6.3.3.1 and 6.5.2.6). The excerpts below from end-users provides evidence of the learning taking place during their interaction with implementers at a meeting, which took place in the village. It is important to note that during community meetings, several people deliver speeches, and that the meeting reported above by *Stove producer 1* is the same reported under this section, the difference is that *stove producer 1* quoted the promoter. The citations below provide evidence of the learning that took place at that meeting:

> *TSF & ICS user VN: What we learnt at the meeting was that when we use the stove we would be saving firewood – we should not destroy trees because as we are using the stove we will be using less firewood, because people are destroying trees through charcoal burning and forests are diminishing as a result rainfall is erratic here. In fact, I should say that rainfall is erratic here. So they were saying it is because people are cutting down many trees. So if you can cut one tree and use the stove, then you will save many trees and rainfall may improve. That is what they taught us.* (Interview # BK4)

> *TSF user KG: That time – this NGO, I remember, it has been a long time, and we were called for a meeting at the Chief. So, that time they said that there is an organisation that would like to introduce cook stoves so they needed to find people who want to be producing stoves, or those who wanted should volunteer themselves, and people were selected. … so they were saying that the stoves are helpful because even if you have few pieces of firewood you can cook relish, nsima because the stove heats up. So even when the fire has diminished food can still properly cook with just the heat retained by the stove. Yes, that is what we learnt.* (Interview # BK6)

The Field Facilitator supported the learning interaction and the content they provide to the end-users:

> *Field Facilitator LM: … we go around and hire DJ (disc jockey) and go around communities and inform them about-aaa-it's related to stove and climate change so that they should see the linkages between stoves and climate change and people should start making reactions, … because at present they have seen that climate change is now real and how it is linked to stove usage.* (Interview # BK 11)

When I asked about the topics they discuss during road shows and/ or the demonstrations the field Facilitator responded:

> *Field Facilitator LM: OK some of the topics that we discussed on these road shows is for example ... linking stoves to climate change, the importance of stoves and how stoves are used, and how stoves can positively reduce issues of deforestation. So these are combined together.* (Interview # BK11)

The additional content different from the previous sections is on how to use the stove; however this was not evident form the user perspective.

Learning interactions between stove producers and implementers and the content of the learning: There were few learning interactions identified between stove producers and implementers. This could be because there seem to be tenuous interaction between them (see Section 5.5.3). The citation below provides evidence of the learning interaction between the stove producers and implementers:

> *Stove producer 1: …. That is when the Field Facilitator came and told us that we need to form a group … we dug a pit for fermenting clay by following the instructions that he gave us. Then we put the clay in the pit and started to pour some water after every three days until 14 days. After 14 days, we called the Field Facilitator to come and see if the clay was ready. … He came, saw the clay, and sent us a trainer.* (GP Interview # BK10)

In the above citation, the stove producer is the learning subject. The content of the learning is the process followed in clay preparation for stove production.

Learning interactions between stove producers and trainers and the content of learning: I also identified learning interactions between the stove producers and the trainer. Their interaction is limited since, when the producers master the skill of stove production, the trainer goes away. The citation below provides evidence of the interaction and the content of their learning:

> *Stove producer 1: So when the Field Facilitator went back, he sent a trainer who helped us and taught us how to make stoves. … When the stove were dry we called the Field Facilitator, he saw the stoves and told us that we should fetch firewood for firing the stoves, but they have to be dry because if we use undried firewood, the stoves will have black patches from smoke. ... Then the trainer came back to teach us how to fire the stoves.* (Interview # BK10)

In the above excerpt, the stove producers learn some quality control tips that should prevent the stoves from having dark patches from undried firewood from the implementer; at the same time, they learn how to make and fire stoves from the trainer. They were also learning how to use new tools such as the new moulds.

The stove trainer substantiated the learning interaction between her and the producers in the following excerpt:

> *Stove trainer: When the new moulds came (the pedal moulds) I went back to teach the group how to use it and make stoves. This was like refreshing the training on stove production since it involved the same people I trained previously.* (Interview # BK14)

Learning interactions between stove promoters and implementers and the content of learning: There were also learning interactions between stove promoters and implementers as the following excerpts illustrate:

> *Stove promoter: What we learnt there was that when we want to do business the first thing is to think of the profit you can get from the business you would like to venture in or how much money*

you would spend to start the business. So, I need to calculate all that. After calculating then I need to see whether I would make profit or not. If I find that I cannot make profit, it is important not to start that business. They were also teaching us that a business does not only entail buying things and selling, it is about any work that you can choose to do and make profit from it. If for example you choose farming, it means you can decide from that business that this year I would like to buy so many bags of fertiliser - together with seeds. Then you add all that together and decide, if I can farm two acres, with the total amount spent plus the labour that will be involved, will I be able to make profit? So changes in the onset of rain season, are some of the things that can delay the business, and are setbacks. So they said farming is a good business but because of changes in climate, we can venture in any business. However, we should make sure that we should write down everything that is needed to start the business. (Interview # BK12)

The Field Facilitator also substantiated the learning taking place in the quotes below:

Field Facilitator LM: What we did with the previous project was to train those promoters in stove and in stove production, and they should know the importance of those stoves … So our role is just to link with her (stove promoter), give her the right skills in stove marketing and promotion. We give her the right training in how to mobilise communities, how to market the stoves and to make sure that many stoves are sold at one goal. (Interview # BK11)

The stove promoter also learned together with stove producers in stove production and firing as the following excerpt illustrate:

Stove producer 2: Everything that we learn, we learn together with the stove promoter. (GP Interview # BK 10)

In the above excerpts, the learning subject is the stove promoter. The content of the learning includes understanding the stove and its importance, stove production and firing, marketing, promotion and business skills.

Learning interactions between implementers and trainers and the content of learning: I also identified learning interactions between the trainers and implementers as evidenced from the quotes below:

Researcher: Are you saying the one responsible for training production groups in stove production is the organisation (Concern Universal)?

Stove promoter: Yes, the organisation finds someone who is interested, but has also undergone training in stove production, so they send that person to some places to teach others in stove production. (Interview # BK12)

The stove trainers confirmed that she got her training from implementers:

Stove trainer: So in 2009 I was picked by a Field Facilitator from Concern Universal to go to Kuyitanda Village to check the stoves that had been produced by a certain group, and select the good ones […] so that only the good ones should be fired. In 2010 when I was busy producing stoves the Field Facilitator came again and asked me to test clay soil they brought me. Then later I told them the results. (Interview # BK14)

In the above citations, the learning subject is the stove trainer who is sharpening her skills in learning quality stoves and she puts in practice what she learnt on soil testing.

Table 5.1 provides a summary of the learning interactions, the learning subject and the content of learning.

Table 5.1: Summary of learning interactions and content of learning

Learning interactions	Learning subject (Who is learning?)	Content of the learning (What are they learning?)
Stove producers and stove producers	Stove producer	Perfecting stove moulding skills
End-users learn and end-users	End-user	Firewood saving of ICS
Implementers from experienced implementers	Inexperienced implementer	Understanding an ICS and its, benefits, moulding, quality control tools, dissemination of ICSs
End users *versus* stove promoters, stove producer, and stove implementer	End-user	Benefits of the improved cook stove in retaining heat and saving firewood, and in return contributing to saving the remaining trees and forests. The message links deforestation to climate change and variability, especially the changes in rainfall patterns, particularly little and erratic rainfall experienced in the area.
Stove producers and implementers	Stove producer	Clay preparation for stove production
Stove producers and stove trainers	Stove producers	Moulding and firing stoves
Stove promoter and implementers	Stove promoter	Understanding ICS and its importance, stove production and firing, marketing, promotion of ICS and general business skills
Stove trainers and implementers	Stove trainer	Stove production, building a kiln, firing stoves, understanding quality stoves and clay soil testing.

Source: Jalasi, 2018

Table 5.1 shows the learning taking place among actors and that content of learning is relevant to the role the actors play in the ICS practice. Since the focus of the study is on uptake and use of the ICS, I would like to highlight end-user learning of the technology and show how the way they learn may hinder or facilitate uptake and use of the technology. From the findings, the end user is learning from stove producers, stove promoter and implementer. However, the learning interaction between the stove producer and end-user is stronger compared to the tenuous interaction between the end-user and stove promoter, and between end-user and implementer as discussed above. This is problematic because in the division of labour for the promoter and implementer, the two are responsible for facilitating end-user learning of the technology (see Figures 5.2 and 5.3). Yet the producer is taking up the role, which is not prescribed; worse still they were not equipped with appropriate knowledge to do this (see Figure 5.5). The problematic situation is discussed in detail in Chapter 6, Section 6.3.3.1.

In summary, the findings indicate that learning interactions were unidirectional (see the arrows in Figure 5.21). The trainer learns from the implementer; the producer learns from the trainer and implementer; the end-user learns from the producer, promoter, and implementer; the promoter learns from the implementer. It is important to note that there was no evidence of the implementer learning from subjects

of other activity systems. Findings also indicate that there was no learning interaction between implementer and policy makers. Further, some actors were learning from subjects within their activity systems, including end-users, producers, and implementers as indicated by the connecting circles within the triangles.

The learning interactions are indicative of the division of labour among interacting activity systems and prescribed rules set by implementers for the promoter, producer, and trainers. This also applies to the specificity in the content of the learning, as indicated earlier. The unidirectionality of the learning interactions echoes the top-down approaches around innovation development, design, and distribution (Barnes et. al, 1993; Troncoso et al., 2007; Simon et al., 2010).

Further, the policy activity system does not interact with the actors on the ground and no evidence shows that they were learning from any of the actors within the confines of the case study.

5.3.1.2 Learning interactions in Waziloya Makwakwa Village case study

In Waziloya Makwakwa village case study, I identified learning interactions between subjects within activity systems and those between subjects of the different activity systems. I will first discuss the learning interactions between subjects within activity systems and then the learning taking place between subjects of the different activity systems.

● **Learning interactions between actors within activity systems**

ICS users learn from ICS users: I identified learning happening between ICS users, as illustrated below:

> ***Field Facilitator FC:*** *… sometimes you know (in using) three stone fire it's like you are free, children come around and then – but for the stove it's fixed there. But through experience from the ones that are using the stove they said … it becomes very warm that the kitchen – because the whole of that stove becomes hot which means the heat from that one (the stove) it's like the whole kitchen becomes very hot. So at first, yes (there was a problem in understanding) but now much of it we don't explain to them, but what we are saying they should explain themselves, discover the problem, … the solution should be from one using that one (the stove). So it's like we share, OK what is the problem – you are using that stove, they should be explaining one two three four. Can you explain any problem? What should be the way forward? You see, there is somebody who will say no, no that is not the problem. That problem comes because of this. So it's like that sharing of – it's straight from the – within the users themselves.* (Interview # MZ10)

The Field Facilitator indicated that ICS users learn about the challenges experienced when cooking with the ICS, and how to overcome the challenges amongst themselves, whilst he facilitates the process through asking questions, than providing the answers. This is part of learning from each other, and through experience, which comes through interacting with the object. However, this kind of learning was not evident from the perspective of the ICS users from the data collected. Additionally, it is specific to the ICS users.

Implementers learn from fellow implementers: Field Facilitators who implemented cook stove project in Waziloya Makwakwa village case study learnt about the stove from CADECOM Field Facilitators who implemented cook stove project in Balaka. The citations below provide evidence of the learning interaction and the content of their learning:

> ***Project officer:*** *At first when we started constructing the stoves we were only using soil from the anthill, we were not putting cow dung, but the problem was that the stove was cracking a lot and was not staying longer. Then we went for an exposure visit to our colleagues at CADECOM, at Utale in Balaka. They taught us that, to avoid cracking we should add a certain type of grass usually found in dambo areas, cow dung, and soil from anthill and ndhulani, when you mix, it becomes like cement and the stove does not crack and it retains the heat for a long time.* (Interview # MZ8)

> ***Field Facilitator FC:*** *It was in 2012 we went to Balaka, Utale 1 Parish, Mangochi Diocese where we have the same Integrated Community Development Project. Yea. So our colleagues went to Uganda … they went to Uganda for exposure visit so we had learnt from them.* (Interview # MZ10)

> ***Project officer:*** *What we learnt from Balaka was that, we need sand one pail, and then you will judge according to the size of the stove you want to construct …. So we just stuck to those measurements – for instance, we need one pail of cow dung, half pail of grass and we also know that we need three pails of anthill soil, the big ant hill and one pail of the small anthill (ndhulani) … if a person reduces the measurements, the stove will be small as well.* (Interview # MZ8)

In the above citations, the interlocutors indicated that the content of their learning was on how to make a durable stove, which keeps heat for a long time, including the materials and the measurements required to make the stove durable.

- **Existing learning interactions between actors across activity systems and the content of learning**

In Waziloya Makwakwa, I identified two main learning subjects. Figure 5.20 below identifies the learning subjects and the nature of interaction. The dotted lines between actors denote the presence of interaction, the solid arrows denote learning interactions. The arrows identify the learning subject in each interaction. The connected cycles within the triangles indicate learning interaction between subjects of an activity system.
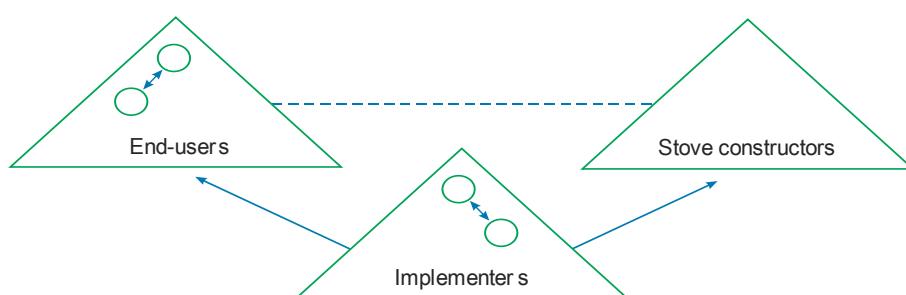
Figure 5.20: Existing interactions and learning interactions among cook stove actors in Waziloya Makwakwa Village case study

Source: Jalasi, 2018

Learning interactions between end-users and implementers and the content of learning: Evidence shows that there were learning interactions between end-users and implementers as indicated in the citations below:

> ***TSF & ICS user MP:*** *The ones who taught us was CADECOM they said the stove cooks better … Everything is cooked at the same time. So, when they taught us we felt that this thing (stove) is good, that is when we decided to construct the stove.* (Interview # MZ5)

> ***Researcher:*** *So what else did the people from CADECOM explain to you about the stove?*

> ***TSF & ICS user MP:*** *When the CADECOM people came, they said you should construct stoves because it reduces the amount of firewood used, because firewood is scarce, when you construct the stove you will be using only few sticks and the food is cooked properly, that is how the CADECOM people explained. So, we understood and took it up to construct the stove and we find that it is true that with three sticks nsima is cooked, and we also put what we want to cook at the same time, water for washing hands, relish and nsima. Now we see that CADECOM has helped us a lot because we used to face problems but now we no longer face problems since the coming of the stove.* (Interview # MZ5)

Another ICS user also substantiated this:

> ***ICS user RS:*** *I knew it from CADECOM … When CADECOM came they told us that firewood is scarce, so for you to use less firewood and use the firewood for a long time to reduce the trips to fetch firewood, you should construct a stove. This is because you can cook many dishes with only one sizable piece of wood and two small twigs with the stove. Here (on a cooking area) you will cook relish, the other place you put water for washing hands when eating, the third place you put nsima which means all these will be done at the same time, and you put at the table at the same time. In addition, the stove heats up and keeps the heat for a long time.* (Interview # MZ6)

Three stone fire users also provide evidence of their interaction with implementers:

> ***TSF user FN:*** *… Yes, they (CADECOM Field Facilitators) said we should make stoves to reduce the amount of firewood for cooking.* (Interview # MZ4.

> ***TSF user FN2[28]:*** *(They said) A stove is important because it helps to reduce the amount of firewood used … when you put two pieces of firewood, it is enough, and this protects forests.* (Interview # MZ4)

> ***TSF user EC:*** *I heard it (about the stove) from CADECOM they were teaching our friends about the stove.* (Interview # MZ3)

> ***ICS user/ stove constructor LJ:*** *We knew stoves from CADECOM, they taught us. … They said that, we fetch firewood from far and with the stove, we will not be fetching firewood frequently. When we fetch, it would take longer to go again because the stove does not consume a lot of firewood. … In addition, when the spouse is not at home, he would find the food still warm on return because after cooking, we put the food on one of the cooking areas and the food would keep warm. When he comes back, he would still find the food warm. That is how they taught us.* (Interview # MZ1)

> ***Researcher:*** *So what about the instruction for using the stove? Did they tell you any instruction on handling the stove?*

---

[28] FN2 was the husband of the woman I was interviewing.

> *ICS user/stove constructor LJ: The Field Facilitator told us that when you are cooking on the stove you should split the firewood; you should take care of it, because if you do not split the firewood, you will be constructing the stoves so many times. So, we understood the instructions because they told us that if you use big logs, we would break the stove, and we use small pieces so that we should not construct many times.* (Interview # MZ1)

In this case study, there was more interaction between end-users and the implementers compared to the other two case studies. During the interaction, end-users learnt about the benefits of the stove, especially the firewood-saving characteristics, which would reduce firewood collection trips, hence protecting forests, and the convenience that the stove brings in saving time for cooking because of the three cooking areas. End-users also learnt about how to take care of the stove such as splitting wood or using small pieces of wood. In this interaction, the learning subject is the end-user.

Learning interaction between stove constructors and implementers: There was also evidence of learning interaction between stove constructors and implementers as the following citations indicate:

> *Researcher: So how do you interact with the Field Facilitators? How do you connect on issues to do with stove?*

> *Stove constructor 1: We interact because they come often to talk about the stoves and that encourages us. They come, sometimes, maybe three or four times in a month to teach us.* (GP Interview # MZ7) (See also Section 5.4.4 for more evidence for this learning interaction.)

> *Project Officer: We started with training volunteers (stove constructors) so that they know how to construct the stoves. Then the volunteers find time to visit households, so that they (other households) should also construct stoves. … that is the main approach we use, that when the volunteers learn, they should also teach others.* (Interview # MZ8)

The Field Facilitator also provided evidence for their interaction with stove constructors (see Section 5.4.4 citation from *Field Facilitator FC).* In this learning interaction, the stove constructors are learning on how to construct the stove. Table 5.2 provides a summary of the learning interactions, the learning subject and the content of learning.

Table 5.2: Summary of learning interactions and content of learning

Learning interactions	Learning subject (Who is learning)	Content of the learning (What are they learning)
ICS users and ICS users	ICS user	Challenges encountered in cooking with ICS, and ways to overcome the challenges
Implementers and experienced implementers	Inexperienced implementer	How to improve stove performance in terms of heat retention and how to make stove durable
End-users and implementers	End -user	ICS benefits such as firewood saving, heat retention, time saving in cooking and collecting firewood (reduction of firewood collection trips), relationship between saving firewood and protecting forests
Stove constructors and implementers	Stove constructors	How to construct stoves, vertical vegetable gardening and other skills under Integrated Community Development project. Stove constructors also learn the content provided to the end-users above, since they learn together during community meetings. (See section 5.4.3)

Source: Jalasi, 2018

Table 5.2 shows the learning taking place among actors. Content of learning is relevant to the role the actor plays in the ICS practice. Since the focus of the study is on adoption and use of the ICS, I would like to highlight that the end-users were learning more from stove implementer. In this case study, there seem to be no obvious learning interaction identified in the data between the end-user and the stove constructors. This could be because of the fixed type stove model, which did not create a space for transaction between constructors and potential stove users, as compared to Chapita village case study where the producer/seller and end-user/buyer were interacting in a selling/buying transaction. In addition, the stove constructors who formed the majority of ICS users seemed to hide information from those who were not attending sensitisation meetings (see section, 5.5.4). However, this does not mean that there was no learning interaction between stove constructors and end-users. This conforms with realist ontology. Sayer (2000) argued that what was known to have happened does not exhaust what could happen or have happened (p.12). This necessitated further analysis to provide evidence of tenuous interaction between the end-users and stove constructors (see Section 5.5.4).

It is also important to note that there were similarities between Chapita Village case study and Waziloya Makwakwa case study regarding the unidirectionality of learning interactions as Figure 5.21 shows.

5.3.1.3 Learning interactions in Chilije Village case study

In Chilije Village case study, I identified learning interactions between subjects within activity systems and those between subjects of the different activity systems. However, there were few examples from data for the learning happening between subjects within activity systems. I will first discuss the learning interactions between subjects of the same activity systems and then the learning taking place between subjects of the different activity systems.

- **Learning interactions between actors within activity systems**

Producers learn from fellow producers: Stove producers learn from each other in order to perfect their stoves during stove making; this was evident in a group interview I carried out with the stove producers as the following excerpt illustrates:

> *Stove producer 4: … we call her (the chairperson) to assist us; we call her – chair how do I do this part, am failing to make this part, whether it is smoothening the sides of the stove. We also ask her to help us in measuring the stove – can you please come and erect this thing here, do as you were trained – since she went for training.* (Interview # DZ5)

In the citations above, the producers are learning how to perfect their stoves with the help of another producer who had more training in stove production.

Implementers learn from other implementers: The Field Facilitator indicated learning how to disseminate cook stoves from GIZ. This is similar to how the *Field Facilitator LM* in Chapita village case study learnt the skills, since they underwent the same training under Nsamala Sustainable Energy project, as discussed earlier. The citation below provides evidence:

> *Field Facilitator JK: … But we learnt the tricks – the tactics from the guys from Mulanje, I think it's GTZ.* (Interview # DZ6)

- **Existing learning interactions among actors between activity systems and the content of the learning during the interactions**

Figure 5.21 below identifies the learning subjects of the activity systems and shows the nature of interaction happening. The dotted lines between actors denote the presence of interaction; the solid arrow indicate learning interaction between them, the arrow also identifies the learning subject in each interaction. In addition, the connecting cycles within the triangles shows learning interaction between subjects within the activity system.
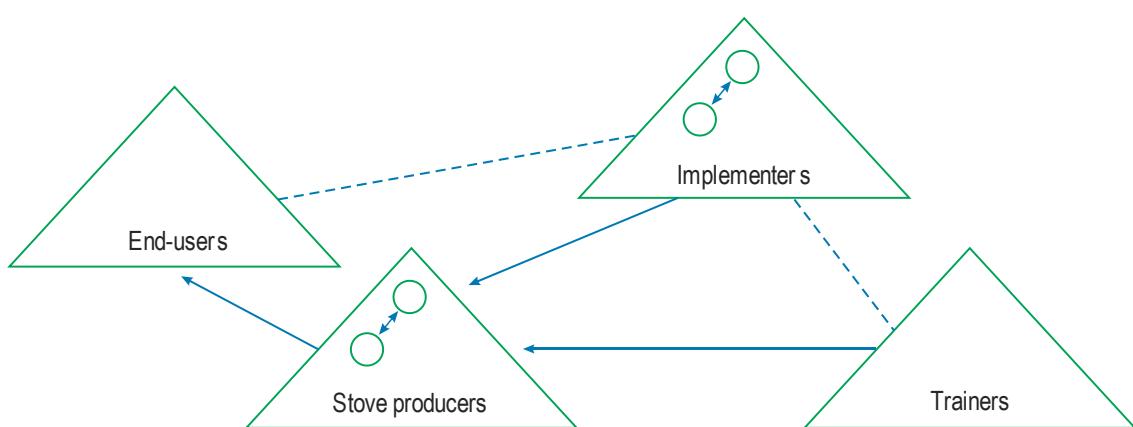
Figure 5.21: Existing interactions and learning interactions among cook stove actors in Chilije Village case study

Source: Jalasi, 2018

Learning interactions between end-users and stove producers and the content of learning: End-users learn more from stove producers. This learning interaction was also evident in Chapita village case study, (see Section 5.3.1.1). There are also some significant similarities in the content of the learning when end-users and stove producers interacted in the two case studies, Chapita village and Chilije village. The following excerpts provide evidence of the learning interactions:

> ***TSF & ICS User GW:*** *I knew it when that group started producing stoves; we went to buy there. They were saying they have produced stoves for sell, so I went to buy. … since they said buy the stove it does not consume firewood.* (Interview # DZ1)

Another ICS user substantiated the learning taking place:

> ***Researcher:*** *Is there anything you learnt about the stove when you got the stove from the producer?*
>
> ***ICS user BP:*** *Yes, she told me how they make the stove. … that I should use small pieces of firewood not big ones.* (Interview # DZ2)

More evidence comes from the TSF & ICS user from the talk turns below:

> ***Researcher:*** *So who told you that the stove uses less firewood?*
>
> ***TSF & ICS user YT:*** *The Chief's wife, she is in the production group.* (Interview # DZ4)
>
> ***Researcher:*** *So apart from that, what else did she tell you about the stove?*
>
> ***TSF & ICS user YT:*** *… that I should get used to the stove because it is good, when it heats up you can cook many dishes, when it heats up it can take a long time to cool.* (Interview # DZ4)

Another TSF user substantiated the interaction and the learning:

> ***TSF User NG:*** *I hear all this because they (stove producers) advertise – they tell us come and buy the stoves because stoves use less firewood. But most of us do not really care. … But the food is well taken care of when you cook on the stove. The smoke from the firewood cannot enter the pot because it is not possible. But the way we cook (on TSF) we get diseases from the smoke because the pot is near to the flames.* (Interview # DZ3)

The *TSF user NG* above learnt about the benefits of using the stove through adverts from stove producers.

Learning interactions between stove producers and implementers and the content of learning: I identified learning interactions between stove producers and implementers as evidenced in the citation below:

> ***Researcher:*** *Now what kind of training do you offer to the production groups apart from training them in making the stove?*
>
> ***Field Facilitator MB:*** *The first thing was to teach them group dynamics – how can they work in a group. And on the production side, there was a section on how to identify suitable clay from stove production and how they can treat the clay, up to the way they can produce the stove, including firing the stove, and the whole process, and how they can store the stoves.* (Interview # DZ7)

Part of the training referred to by the *Field Facilitator MB* is done by a stove trainer, which is reported by *stove producer 3* in the section below. This is because the Field Facilitators sub-contract trainers who do the training while they facilitate the process (see Section 5.2.1.4). In the above citation, the learning subject is the stove producer.

Learning interactions between stove producers and stove trainers and the content of learning:
Stove producers learn about stove-making and building kilns, firing of stoves from stove trainers, and group dynamics. Evidence of this interaction and the learning taking place can be found below:

> **Stove producer 3:** *He (the trainer) came once and stayed for six days.* (Interview # DZ5)
>
> **Researcher:** *So what specifically did he teach you?*
>
> **Stove producer 2:** *Only the stove.* (*I*nterview # DZ5)
>
> **Stove producer 1:** *He also taught us how to build that (pointing at a kiln)…* (Interview # DZ5)
>
> **Stove producer 3:** *… how to load the stoves in the kiln and how to fire the stoves, … and even how to interact in a group.* (Interview # DZ5)

Table 5.3 provides a summary of the learning interactions, the learning subject and the content of learning.

Table 5.3: Summary of learning interactions and content of learning

Learning interactions	Learning subject (Who is learning?)	Content of the learning (What are they learning?)
Stove producers and stove producers	Stove producer	To perfect their stoves with correct measurements and good shapes
Implementers from experienced implementers	Inexperienced implementer	How to disseminate stoves
End-users and stove producers	End user	Firewood saving, heat retention, reduction of smoke and how to use small pieces of firewood
Stove producers and implementers	Stove producer	Identification of suitable clay, and group dynamics
Stove producers and trainers	Stove producer	Moulding and firing stoves, building a kiln

Source: Jalasi, 2018

Table 5.3 shows the learning taking place among actors. The content of learning is relevant to the role the actor plays in the ICS practice. However, some actors did not elaborate, hence in some cases the content does not cover everything that was covered during the learning interaction. For example, *Field Facilitator JK,* representing the implementer in this case study, went through the same training offered by GIZ similar to *Field Facilitator LM* in Chapita village case study. However, *Field Facilitator LM* was more elaborate in providing information on learning content (see Section 5.3.1.1).

Similar to the other two case studies, I would like to highlight that the end-users were learning more from stove producers than from implementers. In Section 5.4.6, evidence from stove producers shows that implementers asked questions of the end-users about advantages and disadvantages of the stove. Despite that one can learn from question and answer, one needs to have some background information

on the phenomenon under study, and this also depends on the feedback the learner receives from the knowledgeable other for the learning to take place. Evidence provided in Section 5.4.6 does not indicate provision of feedback. This explains why Figure 5.21 indicates no learning interaction between end-users and implementers, and that Section 5.3.1.3. does not discuss the learning interaction between them because there was no evidence of what end-users learnt from the implementers from the data. Nevertheless, this does not exhaust what could have happened (Sayer, 2000). This necessitated further analysis to understand what happened. Hence, the discussion on tenuous interaction between implementer and end-users, presented in Section 5.5.1, explains the situation.

5.3.2 Learning Interactions among stakeholders at national level

Apart from interactions among key actors within the three case studies, actors in improved cook stove practice interact at a national level. It is important to note that there is a diverse number of networks and forums among actors at a national level; hence, it was not possible to cover all of these. The criteria I used in selecting the ones included in the study was to limit to interactions that participants mentioned during interviews in the three case studies. This helped me to use forums and networks that are active, to avoid including ghost forums. The information gathered from interviews was augmented with documents in order to provide comprehensive descriptions of the networks and forums.

5.3.2.1 Movement for Bio-Energy Advocacy Utilization Learning and Action (MBAULA) network
Movement for Bio-Energy Advocacy Utilization Learning and Action (MBAULA) is a national network for cook stove implementers and related stakeholders, which was created by participants of the 2012 Cleaner Cooking Camp (CCC) Malawi (see Section 5.3.2.2) in order to enhance sustainable information exchange, cooperation and collaboration between stakeholders (MBAULA website). There is a range of topics that the website covers though it is still under development. However, members interact and learn from each other through sharing information, reading reports and documents on various activities on improved cook stoves, climate change, biomass energy issues, and so on, both locally and globally. A sample of pages from MBAULA website below provides evidence of interaction and information shared.

Figure 5.22: Examples of pages from MBAULA website
(Movement for Bio-energy Advocacy Utilization Learning and Action (MBAULA) homepage, 2015)

As indicated earlier, I selected this forum because there was evidence from interview data that it is active and it provides a learning forum as evidenced below:

> **Researcher:** *So talking about interaction with the different groups that are working with the cook stoves, starting from the users to the production groups, with are the institutions that are working on the promotion of the cook stoves, other institutions, how do you rate your interaction?*

> **Field Facilitator LM:** *There is great interaction between partners, between organisations, yea. There is a network in Balaka with some stove production, those groups that are promoting, those NGOs, in Balaka we just call it stove network. But for country wide, we call it MBAULA network where partners that are doing mbaula (stoves) - yea we … so they sit down and discuss issues to do with promoting and marketing of stoves and to see that there is more interaction among partners. Let me give you an example, we are doing the Chitetezo mbaula, and there is another organisation that is promoting a different kind of stove but it was called the Chitetezo mbaula again, so they met at one point, that network and discussed further about this, so I think that thing has been normalised and they are working together.* (Interview # BK11)

According to the citation above, the content of learning happening focuses on cook stove promotion and marketing. However, it is important to note that, even though there is interaction among actors on the network, some do not have knowledge about the existence of the network:

> **Researcher:** *Do you have any idea of MBAULA network?*

> **Field Facilitator MB:** *No.* (Interview # DZ7)

> **Researcher:** *No?*

> **Field Facilitator MB:** *No* (Interview # DZ7)

Another drawback is that the network requires access to the Internet and computers. However, there are a number of obstacles to Internet access including high taxes, poor infrastructure, and the lack of a local internet exchange points, among other obstacles (Freedom on the net (FOTN), 2015). These make access to Information and Communication Technologies prohibitively expensive for the majority of Malawians and this results in low access rates across the country (ibid.). A 10 percent excise duty on mobile messaging and data transfers introduced in May 2015 further impedes access (ibid.). Hence, the interaction is limited to well-established NGOs and institutions. Moreover, a majority of actors, such as stove promoters, rural stove production groups, stove trainers, and most importantly the end-users, do not have access since a majority of these actors cannot afford a mobile phone, especially not a smart phone.

5.3.2.2 Cleaner Cooking Camp (CCC) Malawi

CCC Malawi started in 2012 under the name Stove Camp. Since then it has been held annually. Both local and international stakeholders working with improved cook stoves in various ways meet to discuss issues pertaining to energy efficient technologies, biomass fuels and cleaner cooking, etc. The forum has deliberated on a range of topics over the five years (2012-2016). Among others, they include promotion,

production and developing marketing strategies of improved cook stoves, appropriateness of improved cooking devices and other energy efficient technologies (MBAULA network; Stove Camp 2012; Stove Camp 2013). Participants also learn about energy efficiency of improved cook stoves, time savings and emissions of different technologies and possible improvements on ICSs, such as improving ventilation (Cleaner Cooking Camp [CCC], 2014). Topics on user practices and fuels are covered. Importantly participants have practically tried out processes and methods of testing different features of stoves; they have developed harmonised criteria and standards that will make future testing results more easily comparable (Stove Camp, 2012). The forum developed a quality control tool for stove production and discussed the National Cook Stove Road Map (Stove Camp, 2013; CCC, 2014; CCC, 2016). Participants of the Stove Camp have included, among others, biomass energy professionals, from Malawi, Germany, South Africa, Uganda, Zambia, and so on, as well as practitioners from various NGOs in Malawi, local entrepreneurs, Malawi Bureau of Standards, National Commission for Science and Technology and local stove promoters. Over the years, the forum has received support from a number of partners including Clioma Ltd., DISCOVER project, Partnership for Cleaner Indoor Air, National Cook Stoves Taskforce, which is now NCCSC (see Chapter 1, Section 1.4.4.2) and several other partners. However, there was no evidence of representatives of stove end-users participating in the forum from the reviewed documents (for example, Stove Camp report 2012; CCC, 2016). The absence of end-users in the forum is also evidenced in the citation from Field Facilitator AC and the trainer from Chapita village case study below.

Field Facilitators in Chapita village and Chilije village case studies substantiated learning interactions that happen at CCC Malawi in the following citations:

> *Field Facilitator AC: We normally have a stove camp every year and this year it will be from 15th to 18th March. … so it's that stove camp upon being convinced that it was able to say no we should- we normally send some people to do for us what is supposed to be done to say go and design this. … it's a good platform for change because we even invite producers, promoters and even extension workers, so we battle it out there. They say this is what we want this is what we want. That's why we came up with this one (the current stove design).* (CM BK1)

> *Field Facilitator JK: We interact; we meet at a stove camp every March. There is a stove camp where we share experience and the like, if there are new things coming in and the like, we are always interacting. But if – that is all about the interaction. …. Yea there have been modifications done to the stove following the same forum. We have adjusted on the size of the stove this and that, some measurements and the like in order to meet the standards that are set for the stove. So that's one of the advantages, sometimes you also get exposed to new stoves on the market. … So we have shared a lot on these forums, sometimes on the marketing aspects of it and the promotion, production and so on.* (Interview # DZ6)

> *Field Facilitator MB: I remember only – we had that forum in 2013 when we had a stove camp. We met different organisations promoting improved cook stoves within Malawi and other countries we had Zambia, Rwanda, yea. It was a one-week function. Participants were trained on how to*

make stoves and there was sharing of experiences on issues of stove adoption and production. (Interview # DZ7)

In the citations above end-users were not mentioned. The trainer from Chapita village case study provides further evidence:

Researcher: Have you ever attended stove camp?

Trainer: No. I have never. … Mostly the Field Facilitators attend those meetings; we are not invited to attend. (Interview # BK14)

Further, during BCCLWs end-users appeared to have no knowledge about the stove camp.

Despite the existing learning interaction among stakeholders at this forum, other cook stove implementing institutions are not aware of its existence. For example, CADECOM Field Facilitator and Project Officer indicated no knowledge of this interaction forum:

Researcher: Is there any national body, which coordinates the cook stove practice at national level in the country that you link with or relate with?

Project Officer: No. (Interview #MZ8)

Researcher: No?

Project Officer: There is no body that we link with on issues of cook stoves. (Interview #MZ8)

The Field Facilitator FC from CADECOM also indicated that he did not know about the existence of the forum (Chisoni, 2015).

5.3.2.3 National Cook Stove Steering Committee (NCSSC)

NCSSC was set up in order to drive the national agenda of rolling out two million stoves as indicated earlier (see Section 5.2.1.1) as well as overcoming any barriers that may prevent meeting the targeted two million stoves. Figure 5.23 below shows the levels of interaction among stakeholders within the NCSSC. The citation below substantiates the interaction happening among stakeholders:

Deputy Director DoEA: Yea we were interacting in this initially we called the National Cook stove taskforce, is chaired by us and we have all the prominent or key government stakeholders […]. Now this has graduated, it is the Steering Committee, which is looking at broader issues, the policy issues just to see what it is that we can do to make life going. (Interview # BK13)

However, it is important to note that the academia were not proactive by the time I collected mirror data as indicated by the Deputy Director DoEA (see Chapter 6, Section 6.3.4.2). During meetings and workshops, organised by NCSSC, stakeholders learn from each other on how to overcome some challenges encountered in the production of stoves among other things. An example is provided below:

Project Manager Concern Universal/ NCSSC Coordinator: Actually, we had a final evaluation workshop last week there were interesting lessons, interesting innovations on how people overcome some of the challenges like firewood curing, yes, the process of production uses an efficient kiln such that you only use one cubic metre – under one cubic metre of firewood to fire over hundred stoves. …. But in some areas still even to find that one cubic metre of trees is a

challenge. So there have been some innovations in some areas like in Karonga where there is a waste management program of rice husks; they ended up using rice husks to fire cook stoves. So that was a bit of innovation on their side that they abandoned the kilns that we taught them and started using agricultural waste to fire the stoves so it has a dual role of being environmentally friendly by consuming, instead of having the rice husks somewhere rotting, now it's better. (CP BK)

The citation below substantiates the learning taking place among stakeholders within the NCSSC:

Deputy Director DoEA: Yea there are two approaches, one we encouraged what I can say intergroup networking, so that they learn from each other what the other is doing, then periodically we do assemble them just to learn the best practices to share ideas to share information to do joint evaluations so that is what is happening. We just had one about two weeks ago whereby we noticed that others learnt a lot from others while others were not particularly good just to get information from others. … yea so there is inter-learning, we are learning from them and yea. (CP BK)
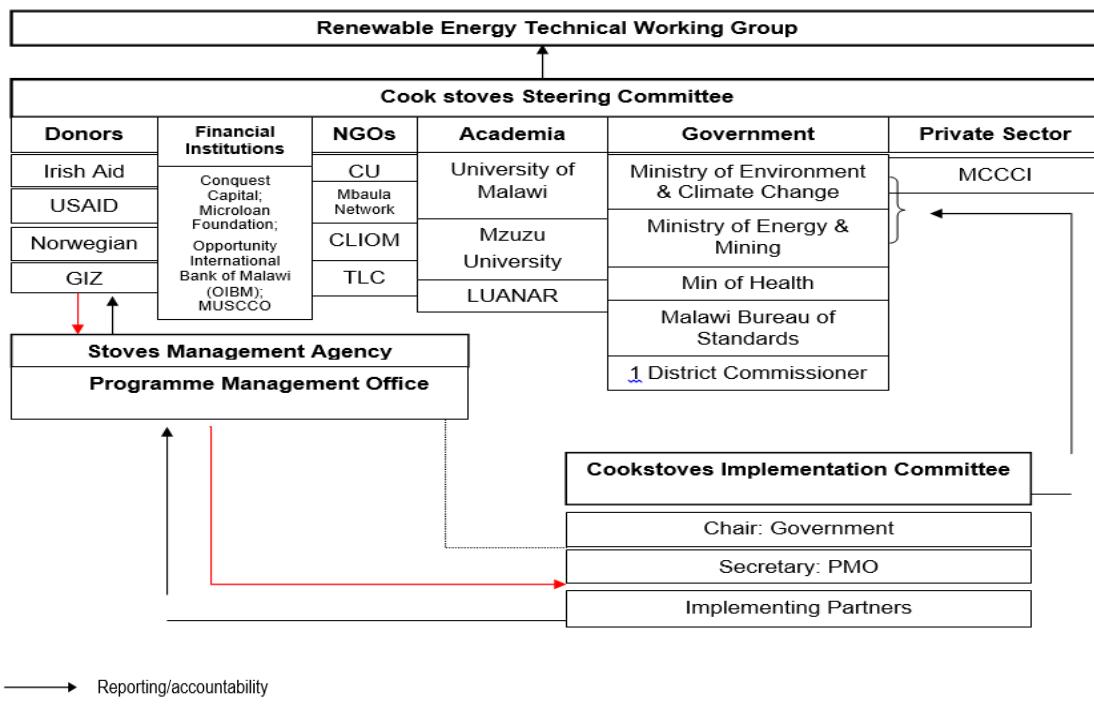
Figure 5.23: The National Cook Stove Steering Committee programme organisation structure
Source: Government of Malawi, 2014, p. 26

The NCSSC involves high-level interaction, which excludes key actors on the ground, especially representatives from end-users, village production groups, local stove promoters and trainers. However, the group of actors excluded is key in driving the agenda for successful adoption and use of the ICS since it constitutes potential ICS end-users. This problematic situation is discussed further in detail in Chapter 6, Section 6.3.4.1.

5.3.2.4 Summary of learning interactions at national forums and in the three case studies

Stakeholders who participate in the three forums learn more about ICS. Diverse topics are covered, however the focus areas include understanding energy efficient technologies, ICS and how to improve ICS performance through following established standards, production of ICS, promotion, marketing, adoption and addressing challenges encountered in the focus areas through sharing expertise and experiences. However, other stove implementing institutions are not aware of the forums. This provides evidence that the ICS practice is still fragmented, which was also observed in the Cook Stoves Road Map programme document (2014). The forums also seem to exclude the key actors on the ground; of major importance to the focus of the study are representatives of end-users and rural based production groups who are key to influencing adoption and use of ICS in rural areas. In addition, issues of adoption and use of ICS remain at stake (see Chapter 4) despite the learning interactions in the foregoing discussion. This opens up questions pertaining to how the actors are learning the technology, which I have discussed in Section 5.4 below. Furthermore, the contradictions identified and analysed in Chapter 6 may shed light on why adoption and use is still problematic. This is because the learning discussed in this chapter seemed not to have dealt with the contradictions that prevent sustained use of the ICS. This gap gave me the impetus to facilitate expansive learning in order to find locally acceptable solutions to the problematic situations as discussed in Chapters 7 and 8.

5.4 How do actors learn Improved Cook Stove technology?

This section discusses the actions actors are involved in, when learning the ICS innovation. As indicated earlier, I drew from several learning theorists to analyse how actors learn ICS. The discussion combines the three case studies in order to avoid repetition because there were more similarities in the ways the actors were learning the innovation. Under each category, I use examples from each case study, where available, to provide evidence.

5.4.1 Learning through training

In the three case studies, I found that some actors were learning the ICS through training. In the Chapita village case study, learning through training was evident from the Field Facilitator, stove promoters and stove producers as the following citations illustrate:

> **Field Facilitator LM:** *A first it was difficult because I had no knowledge about stoves and how to roll out stoves to communities. But after undergoing some training … now I can say I am an expert in promoting stoves in Balaka. … the training was organised by the project [Nsamala Sustainable Energy] but we sought the expertise of those people from GIZ.* (Interview # BK11)

The Stove promoter and producer also indicated that they went through some training when they started working with the ICS:

Stove promoter: Yes, I have. The first training was about how we can teach adults. The second training was about how we can market stoves, especially it was about businesses. (Interview # BK12)

Stove producer 1: … after teaching us for three days, we were able to make the stove and showed some skills. However, some had problems and the trainer was assisting them. And we all learnt how to make stoves that we felt that even if the trainer left we can stand on our own. … When we removed the stoves from the kiln we felt that we had succeeded and that on our own we can fire the stoves without the guidance of the Field Facilitator. (Interview # BK10)

Stove trainer: … we were 15 women when they trained us … because that time stoves were new in Balaka and nobody knew about them …. So they told us that when we complete the training they would choose one person who has demonstrated skill, so at the end they chose … and me. (Interview # BK14).

Learning through training was also evident in Chilije village case study:

Field Facilitator JK: … But we learnt the tricks – the tactics from these guys from Mulanje, I think it is GTZ. … we did it in Nsamala, Balaka, and we did it better than the ones who taught us, and they were wondering, how come? (Interview # DZ6)

Stove producer 3: For us to start producing, a trainer came to teach us his name was [mentions name of a person]. (Interview # DZ5)

Learning through training was also evident in Waziloya Makwakwa village case study as the excerpts below illustrate:

ICS user RS/stove constructor: I learnt it from CADECOM. … They came to teach us, they put us in groups. Now I am in CADECOM group, learning things from CADECOM. … About stoves, planting vegetables in bags, vegetable gardening in dambo areas. (Interview # MZ6)

The Project Officer also provided more evidence of learning through training:

Project Officer: There was a trip to Uganda. However, our colleagues went. They brought the first type of stove that we were constructing in the middle of the kitchen … When they got the training, they trained us how to construct the stove. Then later on, someone told us that we could compare with others who were doing something similar to our stove. Therefore, we consulted our colleagues at Utale in Balaka in order to learn the other type and compare, and we admired the one our colleagues were making. (Interview #MZ8)

See also Section 5.3.1.2 for more evidence on learning through training.

5.4.2 Learning through practice

I also found that some actors in Chapita Village and Waziloya Makwakwa Village case studies learn ICS through practice. The stove trainers received training in stove production and through practice, they perfected their skills and became experts in stove production as indicated in the citation below. They used the expertise to train production groups (see Section 5.3.1.1).

Stove trainer: … I never knew how to make stoves in the past, but now I am an expert … even right now, if someone can ask me to make 100 stoves, I will produce them and give them … (Interview # BK14)

In the Waziloya Makwakwa Village case study, stove constructors indicated that they would like to extend their work to nearby areas outside the project area because they have become experts in stove construction through practising:

> **Stove constructor 3:** *How can you teach us so that we should be motivated and have more energy so that we should get organised to construct* [stoves] *for our friends those who request us from farther places? … because we now have the expertise in these things* [stove construction] (Interview # MZ7).

Learning through sensitisation meetings, open days, road shows and demonstrations

Learning through sensitization meetings, open days, road shows and demonstrations was evident in Chapita village and Waziloya Makwakwa village case studies as the following citations illustrate:

> **Field Facilitator LM:** *And at first when we mobilized our communities for these energy efficient cook stoves it was difficult for them to accommodate our ideas and buy our stoves, but after undergoing […]open days, market demonstrations and after giving them knowledge about the importance of stove, now they became aware of the importance and people started buying the stoves. We also conduct road shows, where we hire DJ and go around communities […]* (Interview # BK11).

> **TSF & ICS user VN:** *I remember they (implementers and stove promoter) called us for a meeting; they came at the Chief. So we went and they were encouraging us about the stove; that was the time they put up the billboard you see there with pictures of cook stoves. They […] showed us the people who had undergone training in stove production and said we should find those people when we want stoves.* (Interview # BK4).

See also section 5.3.1.1 for further evidence on learning through sensitization meetings.

Learning from sensitization meetings and demonstrations was also evident in Waziloya Makwakwa village case study:

> **TSF user AN**: *I heard it from CADECOM, I went once (at a meeting) and they said we should construct stoves.* (Interview # MZ2).

> **Chair CADECOM project Committee**: *The message (about stoves) comes to the Group Village Headman, and he calls people in the community, and tell them that there are visitors who have a message to deliver. […] because that will help in spreading the message to many people since we all need to protect our forest. Forests should not concern only one person, it concerns everyone and it is important that everyone hear the message.* (Interview # MZ2).

The *Project Officer* and *Field Facilitator FC* substantiated how they reach out to end-users through sensitization meetings and demonstrate how to construct the stove:

> **Project officer:** *In order to reach out to the end users, we call for a meeting at the very beginning of the project for all community members […] then you discuss the benefits of stoves and how to construct a stove. When we finish the discussion, we do a demonstration, we construct and they see how it looks like. After that they go (to construct in their homes), some of course can indicate that they cannot manage to construct on their own, and they ask for help. So, we normally teach the whole community together with the volunteers, when a person is ready, she asks the volunteers to go and construct the stove at her house.* (Interview # MZ8).

Field Facilitator FC: So when we are doing our sensitization, we call for the meetings for all village Headmen. From there we do demonstrations. It is from there that you identify people that are able to do it and they can easily follow it. (Interview # MZ10).

5.4.3 Learning through observation

The citations from the *Project Officer* and *Field Facilitator FC* in Section 5.5.3 above also include evidence of learning through observation, which happens when end-users and potential cook stove constructors observe how to construct stoves. In addition, stove producers in the three case studies learn how to mould stoves through observation:

> *Stove producer 1: This will be the first time to train us in that [CCT], so that we become promoters … they took us for training at Kachenga, that we should see the difference (between TSF & ICS in CCT) so that when we go to our areas we should disseminate the experiments.* (Interview # BK10)

The above *stove producer 1* was trained through observing how CCT is done in order to take up the role of promoter so that she could demonstrate to end-users how it is done.

Evidence also shows that in the Waziloya Makwakwa village case study, members of the construction group learnt how to make stoves through observation and doing what they had observed:

> *Stove constructor 1: At first they taught us theoretically and then they said you need to get the construction materials so that you should see how we make stoves. So then we went to collect all the materials, we collected the soil from the anthill, ndhulani, banana trunk, and all materials we needed for stove construction. Then the teacher came back and showed us how to work with the soil. We started mixing the cob and then started to make stoves.* (Interview # MZ7)

Members also indicated that they visited an older group that was experienced with stove construction where they did the practical part of the lessons. In this case, there was a combination of training and observation:

> *Stove constructor 1: Of course, it took some time to visit that place where we went to learn how to construct the stove.* (Interview # MZ7)

> *Stove constructor 3: We went for a visit.* (Interview # MZ7)

> *Stove constructor 2: We only did theory from here, but for practical, it was in Tchesamo.* (Interview # MZ7)

> *ICS user/ stove constructor LJ: We were there when they [CADECOM Field Facilitators] were making the stove, we started in this house, and we were in a group and we were observing.* (Interview # MZ1)

The implementers substantiated this, as seen below:

> *Project officer: … we also organise exposure visits, people would go and visit others so that they can see what others are doing and bring the skills here.* (Interview # MZ8)

> *Field Facilitator FC: … first we do the demonstrations, we make one (stove), from there we go to the one that is OK [completed] that's the second one, from there we go to another house that he/she is really (actually) using that one [the stove]. So it's like in the early stages (of the promotion), so [the learning is] from the process itself, and the last one [stove] that is now in use [he/she] explains how it works. So it's like that person really would really make a difference, … am*

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using this one maybe for three months, [and he/she will give] an example [a testimony], I used to go fetch firewood five times in a month. But the person who does not have a stove still goes five times, yet the one with the stove goes twice. So that one brings another evidence that the stove really helps. … For the demonstration we had exchange visit from Ehlonipeni, they went to Tchesamo area. So there … we did the making process, the materials, the whole process of making that one [the stove], then we went from the second house we opened that one (the stoves), then now visiting other kitchens. So people were explaining for that one … from there we went to the site again. So, it's like the exchange visits they really help actually to understand. (Interview # MZ10).

In the citation above the Field Facilitator also indicates that they use testimonials from ICS users to share with the TSF users. Learning through observation was also evident in Chilije village case study (see Section 5.3.1.3).

5.4.4 Learning through casual meetings and spotting the ICSs

End-users also reported learning about the stove from casual meetings and spotting the stove. This way of learning was common across the three case studies as evidenced from the citations below:

TSF & ICS user FK: They just tell us when we meet by chance. (Interview # BK5)

TSF & ICS user VN: When the stoves first came in the village, I was not around, but I heard about it when I reached at the house of that woman you were with yesterday. So I just went there and left some money because I found that they were sold out, I just booked. (Interview # BK4)

TSF & ICS user II: I just saw the stoves after they had produced and I was interested in them and I went to buy. (Interview # BK3)

ICS user SM: I learnt this type of stove in the northern region (of Malawi) in 2004, because I found that many people were not using three stone fire. […] So I saw it properly where I was staying how it looks like, so I said to myself, if I can learn on my own, and I constructed it and saw that I tried, but nobody taught me. (Interview # BK2)

In Chilije village case study, one user substantiated this:

Researcher: So it shows to me that whatever you know about the stove is from hearing it around from other people.

TSF user NG: I have actually seen the stoves. (Interview # DZ 3)

Researcher: Where did you see them?

TSF user NG: At Chief (mentions name), that is where you find heaps (of stoves). (Interview # DZ3)

In the Waziloya Makwakwa village case study, some end-users learned about the stove from casual meetings:

TSF User AN: This one [the project chair] told me at a certain time when we were at a funeral. … She said the stove is good because when you fetch one bundle of firewood it takes you longer than cooking on the three stone fire. (Interview # MZ2)

Stove constructors substantiate that end-users learned from casual meetings and spotting the stoves:

Stove constructor 1: When some people are passing and see us doing this job (constructing stoves), they admire and come closer to see what we are doing, and they say you should come to construct for me. When someone says that, we know that she is interested and we decide to go and construct for her. We tell her all materials and quantities to collect. (Interview # MZ7)

Researcher: So there is no specific way that you meet the end-user?

Stove constructor 1: No. … we don't, but that is how we meet when someone admires. (Interview # MZ7).

Researcher: One just sees?

Stove Constructor 1: Just sees. … They also see when we cook on the stove. Since we visit each other. Also, when there is a funeral some people come from further places and when they enter the kitchen they see something strange, so they ask right at that place, that how do you make this. So when they meet us in a group we start explaining to them how we do it. When they are interested, they ask us to go and construct for them. (Interview # MZ7)

5.4.5 Learning through question and answer

Learning through question and answer was identified when implementers interacted with end-users. The type of questions included verification type. However, the knowledge end-users used to respond to the questions was learnt from interaction with other actors, as indicated in Section 5.3.1. In the Chilije village case study, I gathered that the implementers did not initially sensitise the end-users, but came to verify their knowledge on ICS. The following excerpts from a group interview carried out with stove producers (who are also end-users) provide evidence:

Researcher: So how do the end users know and learn about the stove? (Interview # DZ5)

Stove producer 1: It seems there was a man who came, he was coming on Concern Universal projects, he moved around the households. (Interview # DZ5)

Stove producer 3: … yes that one [mentions name of Field Facilitator] he moved around the households, I think … when he found a person he was asking them the advantages and disadvantages of the stove, and the person was answering about the advantages of the stove. (GP Interview # DZ5)

Researcher: Was he just asking them about the advantages and disadvantages only?

Participants: Yes. (GP Interview # DZ5)

Researcher: But did he teach the end-users before the advantages and disadvantages of the stove?

Stove producers 3: No, he [Field Facilitator] had not taught them. (GP Interview # DZ5)

Stove producer 2: No, he was just asking questions. (GP Interview # DZ5)

Stove producer 3: He just came and moved around the households that have a stove. (Interview # DZ5)

Stove producer 1: Yes, [I agree with the rest] and when he found a person, he was asking them to explain advantages or disadvantages of a stove. He also was asking about which is better when making fire between the stove and the three stone fire. (GP Interview # DZ5).

The findings from this section, specifically from Chilije case study correspond with the findings in Section 5.3.1.3 that no learning interaction between end-users and implementers was identified.

Learning through question and answer was also evident from Chapita village from one participant:

> *ICS user FJ: I was surprised one time we were called across the river, somewhere at the church. We were about twenty people, some people came and were asking us questions about the stoves.* (Interview # BK7)

> *Researcher: So what were they asking specifically?*

> *ICS user FJ: They were asking questions about the stove. They started calling us one by one, then asking our names, and whether we have received pigeon peas, and the crops we grow.* (Interview # BK7)

5.4.6 Actors learning from each other

I also found out that people learnt from each other, especially in stove production and construction groups; they perfected their skills through learning from other members of the group:

> *Stove producer 1: … When a colleague made mistakes, we did not leave them like that, we were explaining to them that the stove was not properly constructed and showed them how to do it. We were not jealous of each other. We were listening to whatever our colleagues would say, and followed, so that we should have a quality stove and that when it came to selling it should not be rejected.* (Interview # BK10)

See Section 5.3.1.3 for evidence of this type of learning from the Chilije case study where production group members are learning from each other.

In the Waziloya Makwakwa case study, I also identified this kind of learning:

> *Stove constructor 3: We learnt this from our friends.* (Interview # MZ7)

> *Stove constructor 1: We learnt from our friends from Tchesamo.* (Interview # MZ7)

> *Stove constructor 3: Where the stove practice started.* (Interview # MZ7)

At the national level, some actors were learning from each other during workshops such as CCC Malawi, NCSSC evaluation workshops (see Sections 5.3.2.2 and 5.3.2.3, respectively). In addition, they were learning through sharing information, reading reports and documents from MBAULA website (see Section 5.3.2.1). In the interactions, one also traces examples of learning through training where some research participants reported that they were trained in stove-making (see Section 5.3.2.2 citation from *Field Facilitator MB*).

5.4.7 Summary on how actors are learning Improved Cook Stove technology

From the ongoing discussion, actors are learning the innovation in various ways. The differences may be due to the nature of their activity and the context in which they are found. For example, it is almost expected that stove producers learn from observation rather than from sensitisation meetings due to the

nature of their activity. Table 5.4 below provides a summary of how different actors are learning the ICS innovation.

Table 5.4: How actors are learning Improved Cook Stove technology

How actors learn ICS technology	Learning subject
1. Training	Field facilitators, stove promoters, stove producers/constructors, project officers, stove trainer
2. Practice	Field Facilitator, stove constructor, stove trainer
3. Sensitization meetings and demonstrations	End-users
4. Observation	Stove producer/constructor, stove promoter
5. Casual meetings and spotting the stove	End-user
6. Question and answer	End-user
7. Learning from each other and websites	Stove producers, participants at national fora

Source: Jalasi, 2018

5.5 Tenuous interactions among key actors

Despite the learning interactions reported above, I identified tenuous interactions among key actors. The most evident was between implementers and end-users, implementers and stove producers, and promoter and end-users

5.5.1 Tenuous interaction between end-users and implementers

Figure 5.19 shows learning interaction between end-users and implementers; however, the interaction is tenuous and once-off. On the other hand, Figure 5.21 shows no learning interaction between end-users and implementers, as discussed earlier. Most end-users that participated in the interviews in the Chapita and Chilije case studies indicated that they knew and/ or learnt about the stove from the stove producers when they were buying stoves, through casual meetings and seeing the stoves from the producers' homes (see Section 5.4.5). Only few households indicated knowing and learning about the stove from meetings organised by the promoter or the implementers (see Section 5.3.1.1). (See Chapter 6, Section 6.3.3.1 for evidence of tenuous interaction between end-users and implementers for Chapita case study). The quotes below provide further evidence for Chilije village case study:

Researcher: So since you came in the village – do you know the NGO that promotes stoves here?

TSF & ICS user YT: Yes. (Interview # DZ4)

Researcher: Do you know if they came here?

TSF & ICS user YT: They came once to meet the owners, those who produce, not the others such as the end-users. … we hear it from the producers not the implementers. They have never had a meeting with end-users, but with the owners who produce stoves. (Interview # DZ4)

The Field Facilitator also substantiated this:

Field Facilitator JK: I think I did not interact much with the users, I could interact with those I came across while doing some of the work. (Interview # DZ6)

5.5.2 Tenuous interaction between stove promoters and end-users

Tenuous interactions between stove promoter and end-user was attributed mainly to shortage of stove promoters in Chapita village case study; only one stove promoter was responsible for a large zone (see Chapter 6, Section 6.3.3.2). In the Chilije case study, the promoters were not active as indicated by the Field Facilitator below:

> *Field Facilitator JK: Unfortunately, our promoters in Dedza in Dzalanyama we had few challenges … the one in Chilije was not active he was dormant.* (Interview # DZ6)

5.5.3 Tenuous interaction between stove producers and implementers

Tenuous interaction between stove producers and implementers was evident in the Chapita village and Chilije village case studies, as illustrated in the citations below:

> *Stove producer 1: ... When we have a pressing need, we call them on the phone. Usually they only come when we call them to buy the stoves. But when we explain the other problems, they just say, I have heard I will answer you some other time. At least the first Field Facilitator [gives name of person] was visiting us .... The second one [name of person] was coming though not as the first one. The third one does not visit us. It has been long since he visited us, he only came may be three times only.* (Interview # BK10)

> *Researcher: How long ago did he visit you?*

> *Stove Producer 2: A year.* (Interview # BK10)

> *Stove producer 1: A year has gone. Yes, that is another problem we face with the Field Facilitators. Even if you call them on the phone, sometimes it just rings they do not answer. So sometimes we are concerned that, how can we be assisted? There is no assistance.* (Interview # BK10)

The stove promoter echoed the tenuous interaction:

> *Stove promoter: There is a big problem. The problem is that there is tenuous interaction between the Field Facilitators and the stove producers. You know I was only picked to sell stoves, but it [the stove project] has the overseers.* (Interview # BK 12)

This tendency was also found in Chilije case study as illustrated below:

> *Researcher: So how do you meet the Field Facilitator, how do you connect?*

> *Stove producer 3: This is what we have been saying about the problems with the stove activity, it was [name of Field Facilitator] but it has been long since he came here.* (Interview # DZ 5)

> *Researcher: Does that mean that he had not followed up on your progress after you started stove production?*

> *Stove producer 2: … No we do not meet him, the only time we used to meet was when he was coming to carry the clay for us.* (Interview # DZ 5)

> *Stove producer 3: He said that he had left and there would be another one coming, so since that time the other one has never come to visit us as a group.* (Interview # DZ 5)

> *Stove producer 2: Yes, since he carried the clay and then came to buy the stoves, he never came back.* (Interview # DZ 5)

The group was facing many problems that needed addressing, however they had nobody to help them because the Field Facilitator was not available and the project phased out in the middle of the problems. (See Chapter 6, Section 6.5.3 for detailed discussion of the problems.)

5.5.4 Tenuous interaction between TSF users and ICS users/ stove constructors

In the Waziloya Makwakwa village case study, I gathered that there was tenuous interaction between TSF users and ICS users and between the TSF users and stove construction group (most ICS users were also in the stove construction group). The following quotes provide evidence:

> **Researcher:** *Does a person who does not participate in CADECOM trainings have a chance to have a stove at her house*?
>
> **ICS user (also in construction group):** *That person has to come to us and ask us that she wants a stove, and we should forgive her, in that case, she can have a stove. … because we want that person to attend CADECOM trainings.* (Interview # MZ6)

TSF user AN substantiates the tenuous interaction below:

> **Researcher:** *So what did you hear about stoves?*
>
> **TSF user AN**: *I have never asked.* (Interview # MZ2)
>
> **Researcher:** *You never asked?*
>
> **TSF user AN**: *Even though you may ask, they [the construction groups] do not explain to you. When you ask them, they say why don't you attend the meetings; the stove requires you to attend meetings and learn when they teach us, it needs you to hear it on your own, not from others.* (Interview # MZ2)

The TSF user above indicated that the ICS/ stove constructors do not share information with those who do not attend sensitisation meetings organized by implementers.

5.6 Implications and conclusion

This chapter has discussed the learning taking place in the ICS practice within the three case studies and at national fora. It has identified the learning interactions within and between subjects of the key activity systems identified in each case study. In order to provide the evidence of the learning taking place, the chapter has used a framework proposed by Engeström (2009) to discuss what the subjects learn during their interactions and how they learn the ICS innovation. Much of what subjects learn and how they learn is shaped by the different roles their activity systems play in the ICS practice. However, the unidirectionality of the learning interaction (see Figures 5.19, 5.20 and 5.21) appears to be influenced by the prescribed roles that the implementers set for the producer, promoter, and trainer activity systems, with an exception of the producer activity system. The learning interaction existing between the producer and end user in Figure 5.19 and 5.21 is in fact "a breach of the rules" prescribed for the producer. The prescribed rules have implications for access to information and knowledge on the ICS stove purpose,

performance and handling on the part of the end-user (see Chapter 6, Section 6.3.3.1). Further, the directionality of the learning interactions indicate that the implementer was not learning from the other activity systems in all the three case studies (see Figures 5.19, 5.20 and 5.21). This is evidence of the top-down approaches prevalent in cook stove dissemination as discussed in Chapter 2. The approach has negative implications for the uptake of ICS in the Waziloya Makwakwa case study and sustained use of the ICS in the Chapita and Chilije case studies because implementers have not created space for dialogue with end-users to understand concerns and constraints encountered in their interaction with the ICS. This resulted in some end-users abandoning the ICS when faced with problematic situations as discussed in Chapter 4 (see also Chapter 6, Sections 6.3.3.1 and 6.5.2.6). Further, despite existing learning interactions between the implementer and end-user, and promoter and end-users in Chapita and Chilije case studies, the interaction was tenuous because it was a once-off activity (see Chapter 6 Sections 6.3.3.1 and 6.5.2.6, respectively).

The findings also indicate that most of the learning taking place is informative. Even though inadequate, particularly for end users, the learning focuses on increasing the "fund of knowledge" (Kegan, 2009, p.42) about the ICS, "increasing the repertoire of skills" (Ibid) for producers, implementers, trainers and promoters rather than transformative because it has not transformed "problematic frames of reference" (Mezirow, 2009, p. 92). In many ways, the learning has not facilitated "critical reflection and critical self-reflection" (p.94) within the ICS actors' assumptions, as well as "critical assessment" of the "consequences of the habits of mind" (Ibid). Contradictions identified and analysed in the learning, as well as uptake, use of the ICSs technology (see Chapter 6) substantiate this. For example, evidence indicates lack of end-user training (see Chapter 6, Section 6.3.4.1), as well as putting end-users on the periphery of the development and dissemination of ICS, yet focus is put on training stove production groups, despite that the profile of utilisation is low. This reflects lack of critical assessment on the overall objective of the implementation of ICS technology in the country.

A causal mechanism that appears to shape the way actors are learning the ICS is that the GoM is over reliant on NGOs to implement ICS projects. Both government and NGOs rely on donor funding who usually prescribe outcomes and periods of project implementation. The Deputy Director of DoEA expressed how "conditions prescribed by donors may be met at the expense of both quality as well as adoption" (see Chapter 6, Section 6.3.4.1). This explains the top-down approaches adopted which stem from donor agencies, to the local NGOs, and influences how projects are carried out on the ground, how learning is facilitated (especially for end-users) and how actors learn the technology. A project manager from Concern Universal echoed this when he remarked that NGOs are not much concerned with usage; they usually focus on dissemination and distribution (Chisoni, 2015).

CHAPTER 6: SURFACING AND ANALYSING CONTRADICTIONS

6.1 Introduction

This chapter answers question 3: What contradictions exist in the learning, uptake and utilisation of improved cook stoves?

In this chapter, I surface and analyse contradictions within the three case studies, Chapita Village, Waziloya Makwakwa Village and Chilije Village. I will first discuss discursive manifestations that I used to help me access the contradictions. Second, I will present the contradictions identified and analysed from Chapita Village case study, then Waziloya Makwakwa Village, and finally Chilije village. I will provide a summary of contradictions in a diagrammatic form for each activity system. After each case study, I will provide a summary of the contradictions identified in each case study in a table format. I will conclude the chapter by consolidating generative mechanisms influencing contradictions across case studies. This chapter presents the contradictions as surfaced from mirror data and consolidated with data from Boundary Crossing Change Laboratory Workshops (BCCLW). I found the BCCLW a useful space to elaborate the contradictions as the space provided insightful perspectives from the multi-voiced nature of the workshops as different participants, other than those involved in generating mirror data, participated in the BCCLWs. I have also used document analysis to surface contradictions mainly for the policy activity system for the Chapita case study.

The chapter uses CHAT's second and third generation to surface contradictions. Four types of contradictions are identified across the case studies, including primary, secondary, tertiary and quaternary. The Chapter uses retroductive analysis to surface generative mechanisms that give rise to the contradictions using the lens of Critical Realism.

6.2 Discursive manifestations as a window into systemic contradictions

Engeström and Sannino (2011) argued that contradictions cannot be observed directly (from talk); they can only be identified through their manifestations (p. 369). Therefore, we must approach contradictions via manifestations in the discourse and actions of the players involved (Bonneau, 2013, p.9). Engeström and Sannino (2011) proposed the use of four types of discursive manifestations of contradictions: dilemmas, conflicts, critical conflicts and double binds as framework for empirical analysis as they found the other types too general for developing a robust framework (p. 373). In surfacing of contradictions in this study, I have used discursive manifestations as a window to identifying contradictions. In addition to

the four types presented in the Engeström and Sannino (2011) framework, I have used inconsistency, tension, conflict of motive both individual and 'collective' (expressed as a group) and disturbance, since some contradictions in my data manifested through those types. In addition, I have used actions of subjects to get access to contradictions. Engeström and Sannino (2011) argued that the categorisations used in their framework is "not meant to be an exhaustive categorization" (p. 373). Hence, I have used eight types of discursive manifestations as well as actions of subjects to identify contradictions. This approach helped me to look for contradictions beyond mere expressions within the data; instead, I looked at the whole system and its dynamics, within an activity and interacting activities. Further, Engeström and Sannino (2011) proposed the use of linguistic cues that potentially signal expressions of discursive manifestations within the same framework. Given the differences in the linguistic structures and modes of socialization, between the Bantu language family and European language family, I found the use of linguistic cues somewhat restrictive as pointers to types of discursive manifestations of contradictions in my data; hence, I included actions of subjects too.

Bateson, Sluzki and Ranson, as cited in Engeström and Sannino (2011), described **double binds** as processes in which actors repeatedly face pressing and equally unacceptable alternatives in their activity with seemingly no way out (p. 374). In the context of work activities, the double bind corresponds to situations in which players are in a way caught in a reflexive loop, where they feel pressured to do something, but feel unable to act accordingly (Bonneau, 2013, p.6). "In discourse, double binds are typically expressed first by means of rhetoric questions indicating a cul-de-sac, a pressing need to do something and at the same time a perceived impossibility of action. This impossibility is commonly expressed with the help of desperate rhetorical question" (Engeström & Sannino, 2011, p. 374). However, in my data I found that in some situations, I could trace double binds without rhetorical questions as pointers.

Dockeray (1942) described a situation where motives "get in each other's way". Dockeray argued that a "**conflict of motive** is a situation in which we find ourselves when two motives of approximately equal strength are opposed, each making a claim for satisfaction at the same time" (p.143). He elaborated that "if we act in accordance with the demands of one, we cannot directly satisfy the other" (ibid.). Leont'ev (1978, p.122 as cited in Sannino, 2008a) indicated that motives "are not recognized by the subject" (p. 273). According to Leont'ev, "motives are revealed to consciousness only objectively by means of analysis of activity and its dynamics" (Ibid., p. 273). "Subjectively they appear only in their oblique expression, in the form of experiencing wishes, desires, or striving toward a goal" (Ibid). Vygotsky (as cited in Engeström et al., 2014) gave an example of how a conflict of motive develops when, "upon waking up, a person knows, on one hand, that he must get up and, on the other hand, that he would like to sleep

a little longer" (p. 120). Vygotsky explains that the two motives alternate, appear in consciousness and replace each other (ibid., p. 120). One example from this study is when subjects of stove construction activity system are faced with two conflicting motives between doing the work as skilled volunteers, with no means to generate income, versus generating income out of the expertise they have acquired from stove construction for a livelihood and for supporting stove construction activities (see Section 6.4.4.1). In this study, I have used conflict of motive as expressions of contradictions.

Cameron and Quinn (as cited in Bonneau, 2013) contended that **conflict** emerges out of the perpetuation of a proposal to the detriment of other alternatives (p. 5). "The conflict is expressed as a misunderstanding, a disagreement or diverging points of views and may result in resistance, refusal or rejection" (Bonneau, 2013, p. 5) or criticism and argument (De Dreu & Van de Vliert, as cited in Engeström & Sannino, 2011, p. 373). De Dreu and Van de Vliert (as cited in Engeström & Sannino, 2011) defined conflict as follows:

> *… conflict occurs when an individual or group feels negatively affected by another individual or group, for example, because of a perceived divergence of interests, or because of another's incompatible behaviour.* (p. 373)

Tjosvold (as cited in Engeström & Sannino, 2011) indicated, "people are in conflict when the actions of one person are interfering, obstructing or in some other way making another's behaviour less effective" (p. 374). Some contradictions discussed in this chapter manifested through conflict.

In this study, **tension** shall refer to a state in which people disagree with, and feel anger toward each other; the state is usually latent hostility or opposition between individuals or groups, which may result in a strained relationship between the people or groups involved. I have refined this definition from Merriam-Webster dictionary (1828) and the American Heritage dictionary (2011.). An example from my data is the tension created because of a cracked stove between subjects of the stove production activity system and subjects of the TSF & ICS user activity system (see Section 6.3.2.3).

Engeström (2008) defined disturbances thus,

> **Disturbances** *are deviations from the normal scripted course of events in the work process, normal being defined by plans, explicit rules and instructions, or tacitly assumed traditions. A disturbance may occur between people and their instruments or between two or more people. Disturbance appears in the form of an obstacle, difficulty, failure, disagreement, or conflict.* (p. 24)

When disturbances appear in talk, they are called *"discursive disturbances"* (ibid., p. 24, italics in original text). I have used disturbances as an access to contradictions since, according to Perrow (as cited in Engeström 2008), a singular local disturbance may point to "broader structural tensions in an organization" (ibid., p. 26). In my data, disturbances appear to occur between subjects and rules or tools.

In those instances, they appear in the form of failure to follow stipulated rules or use the scripted available tools, for example, failure to use available tools for sensitising end-users on cook stove innovation.

A *dilemma* may be described as an internal conflict within an employee, who must take on two opposing roles (Bonneau, 2013, p. 6). Bonneau elaborated this by giving an example of managers at a hospital who may face daily pressures due to their twofold responsibility: first, they must provide care to patients; second, they must reduce the costs associated with these services (p. 6). Another definition states that a dilemma is an expression or exchange of incompatible evaluations, either between people or within the discourse of a single person (Engeström & Sannino, 2011). Billing, Condor, Edwards, Gane, Middleton, and Radley (as cited in Engeström & Sannino, 2011) argued that "dilemmas do not refer to the agonized mental states of the decision-maker who is faced with a difficult choice but to aspects of socially shared beliefs, which give rise to the dilemmatic thinking of individuals" (ibid., p. 373).

According to Engeström and Sannino (2011) "***"critical conflicts"*** [italics & bold added] are situations in which people face inner doubts that paralyze them in front of contradictory motives unsolvable by the subject alone" (p. 374). "In social interaction, critical conflicts typically involve feelings of being violated or guilty, often silenced" (Sannino, as cited in Engeström & Sannino, 2011, p. 374). To this definition, I add *"feelings of being subjugated, alienated or excluded (not belonging)"* which I also find in my data (see Section 6.5.2.6). Engeström and Sannino (2011) further elaborated that "the discursive working out of critical conflicts involves personal, emotionally and morally charged accounts that have narrative structure and frequently employ strong metaphors" (p. 374). In my data, however, this was evident in some instances. However, double binds seemed to generate metaphors as well (see Section 6.3.2.1; see also Mukute, 2010).

In this study, *inconsistency* shall refer to self-contradictory approaches. In my data, inconsistency seemed to occur when an approach perceived to facilitate change in two specific behaviours fails to influence one behaviour.

6.3 Contradictions in Chapita Village case study

This case study comprised eight activity systems. I surfaced contradictions from six of the eight activity systems: the implementer activity system, the stove production activity system, the TSF & ICS user activity system, the TSF user activity system, the promoter activity system and the policy activity system. There were no contradictions identified from the data collected within the ICS user activity system and the trainer activity systems.

6.3.1 Contradictions within the TSF & ICS user activity system and between the activity system and implementer activity system

In this section, I discuss six contradictions identified in the TSF & ICS user activity system.

6.3.1.1 Contradiction within the tool (the ICS) manifests as double bind: Satisfying the requirements for firewood saving and heat retention versus delaying cooking/ (no speed in cooking)

This contradiction provides some explanation why end-users abandon the stove after first use or they rarely use it. It was evident from the members of the activity system that the improved cook stove (ICS) does not provide the speed they require in cooking compared to the three stone fire (TSF) as indicated in the excerpts below:

> **TSF & ICS user II:** *… the three stone fire is faster than the stove because we put more sticks on the three stone fire than on the stove… on the stove we put only one or two.* (Interview # BK3)

> **TSF user RA:** *They* [those with stoves] *use the TSF because it is faster … yes the stove delays cooking.* (Interview # BK 9)

> **TSF & ICS user ZJ:** *… on the stove, the food is cooked faster but it cannot compare with the way you would cook on the TSF. This is the reason many people feel that it would be better to cook on the TSF than on the stove.* (Interview # BK1)

The first quotation from *TSF & ICS user II,* gives the impression that the ICS delays cooking because it uses few pieces of firewood and that the TSF is faster because they use more firewood. However, it only reveals the perception that the end-user has, which indicates a problem under the surface. A Field Facilitator from Concern Universal who is also the Sustainable Energy Management Unit (SEMU) Officer in the organisation confirmed and provided a scientific explanation concerning the design of the stove, and how it works, which provided more insights on why women find it slow in cooking.

> **Field Facilitator AC:** *When we do the cooking demonstrations, we show how this works … what happens with this stove is that when you start the TSF and the stove at the same time – we cook beans maybe two and half hours. When it gets to one hour the beans on the TSF look more cooked than the ones on the stove because on the stove what happens is that it has to absorb the heat first before it starts releasing it compared to the TSF. So, when you cook nsima you can say that the TSF is faster than the stove because nsima will only take about 15-20 minutes to cook. … nsima will cook faster on the TSF than on the stove because the stove needs to absorb the heat first, and then starts to release it. So, when you cook things that do not take long to cook, the TSF is faster than the stove, but when you cook things that take longer to cook, this stove is efficient. But the TSF would use more firewood.* (CM BCCLW BK6)

The explanation provided by the Field Facilitator affirmed the manifestation of the contradiction. Most of the food cooked in rural communities on daily basis take less than an hour to cook, such as pumpkin leaves, maize porridge, boiling water for tea and *nsima.* From the quotations above, one would argue that the women abandon the stove because they want to cook their food faster. The stove design contradicts with their requirement for speed as most of the time they skip breakfast either because they

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are coming from gardens when it is almost midday or because they had nothing for breakfast. Hence, speed is a matter of concern when food is available.

Furthermore, during the BCCLWs, participants remarked that the stove does not produce rapid burning fire because of the number of sticks used as observed by *TSF & ICS user II* above. However, a practitioner at the Cleaner Cooking Camp (CCC) 2016, which took place at Sol Farm in Lilongwe on 15-18 March 2016, explained what happens. She indicated that the stove was designed specifically to avoid too much airflow because that inhibits fuel efficiency, which is the primary concern of the stove design (CCC, 2016). This specification reduces rapid burning of fire. This means the stove was designed to respond to environmental concerns and overlooked the socio-cultural aspect of cooking convenience, which is a catalyst in promoting use, to effectively respond to the environmental concerns.

From a different angle, the stove promoter indicated that when one uses the stove frequently, it heats up quickly when you cook because it does not cool off completely:

> *Stove promoter: The problem with the stove is that in the early days of using it, it becomes difficult for fire to burn. When you light fire today, and tomorrow you do not, and the following day you do not, on the day you would light the fire, it burns with difficulties. It requires using it continuously when you first use it. Then it reaches a point when it gets used to the fire.* (Interview # BK12)

However, as observed in the previous quotations, it becomes difficult for the users to continue cooking on the stove because it delays them and therefore there is no period for the stove to adapt in order to retain the heat. This problem is rooted in subjects having inadequate knowledge of handling the stove, especially understanding the design concept of the stove due to lack of user training (see Section 6.3.3.1 below). This is manifested through a double-bind. The women in this activity system are facing firewood shortages. They sometimes use crop residues, for example maize cobs, pigeon peas stalks, etc. Usually, they fetch firewood from the riverbanks that the flooding river leaves behind and from bushes in their gardens as indicated earlier. They find themselves in a situation that they need to use the stove because it is fuel-efficient, at the same time, they abandon the stove because of the contradiction it presents, and the alternative is to go back to TSF despite having the knowledge that it is not fuel-efficient. The contradiction is therefore primary within the tool, the stove as mediating artifact. It aggravates to a secondary contradiction as discussed below.

6.3.1.2 Stove delays cooking versus convenient low energy cooking

A secondary contradiction occurs between the tool and the object as the tool constrains the subject to work on their object to realise their outcomes:

> *TSF & ICS user FK: Now you see that by the time it heats up, water for nsima is already hot on the three stone fire. Those are some of the obstacles people experience that make them cook on the three stone fire.* (Interview # BK5)

6.3.1.3 Contradiction between the outcomes: Speed of cooking, and low firewood use versus reduction of deforestation and reduction of indoor air pollution

Another contradiction identified is quaternary. There is a clash between the outcome of the implementer activity system and the outcomes of the TSF & ICS user activity system. The outcome of the implementer can only be realised if end users utilise the stoves. The citations below give access to the contradiction:

> *Field Facilitator AC: … the TSF is faster than the stove, but when you cook things that take longer to cook this stove is efficient. But the TSF would use more firewood.* (CM BCCLW BK6)

The following exchange also substantiates the above:

> *Researcher: What is the major reason for buying the stove?*
>
> *TSF & ICS user II: The major reason is cooking on the stove.* (Interview # BK3)
>
> *Researcher: I see there is a three stone fire, why the three stone fire?*
>
> *TSF & ICS user II: You know sometimes firewood is difficult to find, and you know that the stove does not consume a lot of firewood compared to the three stone fire. So when I have less firewood I cook on the stove.* (Interview # BK3)
>
> *Researcher: And when you have firewood?*
>
> *TSF & ICS user II: I cook on the three stone fire.* (Interview # BK3)
>
> *Researcher: Why?*
>
> *TSF & ICS user II: Because I have a lot of firewood.* (Interview # BK3)
>
> *Researcher: … Between the TSF and the stove, which one is faster?*
>
> *TSF & ICS user II: The faster one is the TSF.* (Interview # BK3)

The secondary and quaternary contradictions discussed above are related. The primary contradiction aggravates to secondary and influences the quaternary.

6.3.1.4 Contradiction between tool and object: The need to use an improved cook stove to save firewood and struggling to cook nsima *(maize based staple food) on the improved cook stove*

The contradiction manifests itself mainly through action; some women abandon the stove after first use; others use the stove only for cooking dishes other than *nsima.* As much as it is possible to cook in large cooking vessels on the stove, such as heating water in a 20-litre pail, *thobwa* (home-brewed maize based drink), and so on, women struggle to cook *nsima* because *nsima* requires stirring vigorously with both hands when it is stiff in order to make it smooth. This becomes a challenge because the pot slides. Hence, the woman resorts to using one hand to support the pot to prevent it from falling and one hand to stir. This is difficult especially for larger households with larger pots. Also, most pots used in the rural areas do not have a handle; they are called *safuliya*. These are cheaper compared to those with handles. Due to extended family tradition in Malawi, most households are large. The average household size is five

(Malawi. Malawi Demographic and Health Survey, 2010). One user explained the struggle encountered in cooking *nsima* on the stove as follows:

> **TSF & ICS user MB:** *The problem with this stove is that you should not use a pot without handle* (sefuliya)*; you will struggle. The pot has to have a handle if you want to cook* nsima … *for* nsima *it has to have a handle … or else it* [the nsima] *will fall, when you are cooking.* (Interview # BK8)

While cooking in a pot with a handle provides a means for support, it is only possible for cooking *nsima* in a small pot. Those who have large families struggle. One member of the production group who is a TSF and ICS user explained how women struggle when they cook *nsima* on the ICS for large families, and how the struggle influences them to cook on TSF.

> **Stove producer 2:** *It depends on a household … the ones who struggle most are those using that pot* (pointing at a big family size pot). … *Now when they put the big pot they start cooking with one hand, while the other one is supporting the pot, and then the other arm* [the one stirring] *aches, then to use both arms it is not possible. That is where they find a big problem; those households you see cooking on TSF it is because they use big pots due to family sizes.* (GP Interview # BK10)

Due to time constraints in making fire on two different cooking stoves, and coupled with the slowness in cooking on the stove as presented in the contradiction above, they rarely use the ICS and some households abandon it. In this regard, the contradiction is manifesting as a double bind. It is secondary between the tool and the object. It stems from the design of the stove that creates some obstacles when the subject is working on their object, specifically cooking of *nsima*.

6.3.1.5 Contradiction between the stove design that is not adapted to socio-cultural requirements in food preparation and addressing environmental problems

Another clash occurs between the tool of the TSF & ICS user activity system and the outcome of the implementer activity system, making the contradiction quaternary. The contradiction manifests through the citation below:

> **Field Facilitator LM:** *… And we have been going around monitoring, and it's true that other households they are using what – three stone fire, and that is basic, but they are forgetting that the number of firewood that they are using is more than this one* [the stove]. … *because they have to link it to climate change and deforestation and they have to be mindful of the air pollution*. (Interview # BK11)

The contradiction stems from the design of the stove. It is not adapted to cultural requirements around food preparation in Malawi, especially *nsima*. This stems from donor-driven projects, typical of stipulating their agendas, in a top-down approach, overlooking the socio-cultural aspects of the cooking technology, as discussed earlier. This contradiction therefore relates to the one discussed above in terms of their origins. Despite that Chitetezo Mbaula originated from a stove produced by a community in Mulanje in 1999, it has gone through several modifications to respond to scientific requirements, to qualify as an ICS (Chisale, 2015).

6.3.1.6 Summary of contradictions

The figure[29] below summarise the contradictions for this section.
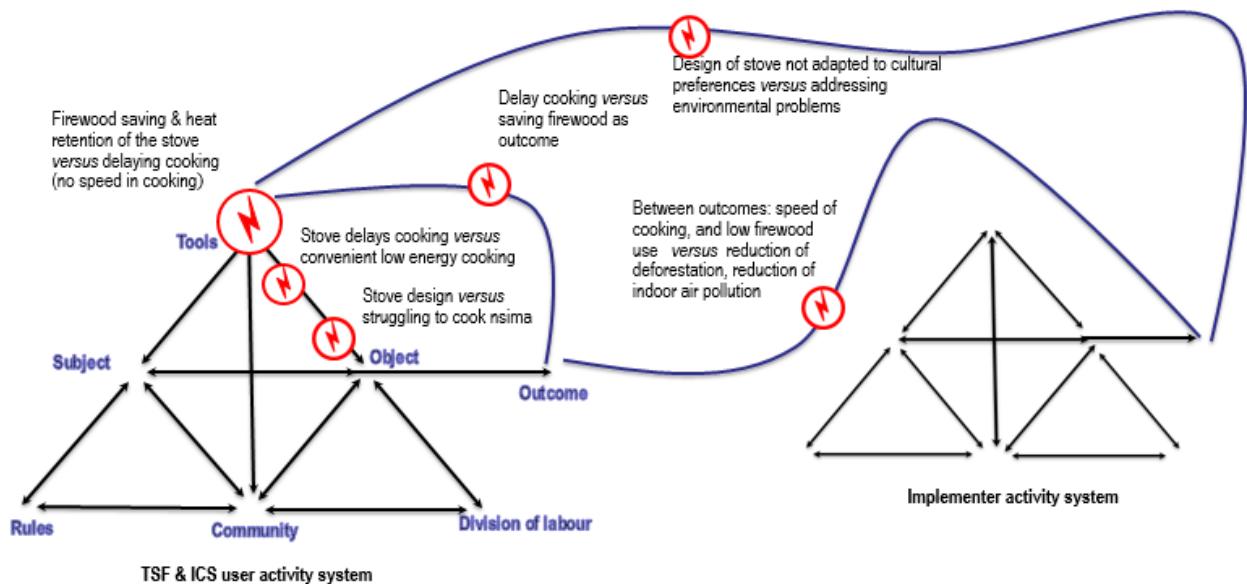
Figure 6.1: Contradiction within the TSF & ICS user activity system
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.3.2 Contradictions within the stove production activity system and between the activity system and the implementer, policy, TSF & ICS user, TSF user, and promoter activity systems

This section discusses contradictions within the cook stove production activity system.

6.3.2.1 Following a cumbersome quality control production process to produce quality stoves versus production of cracked stoves on the upper door that reduce quality of the stoves
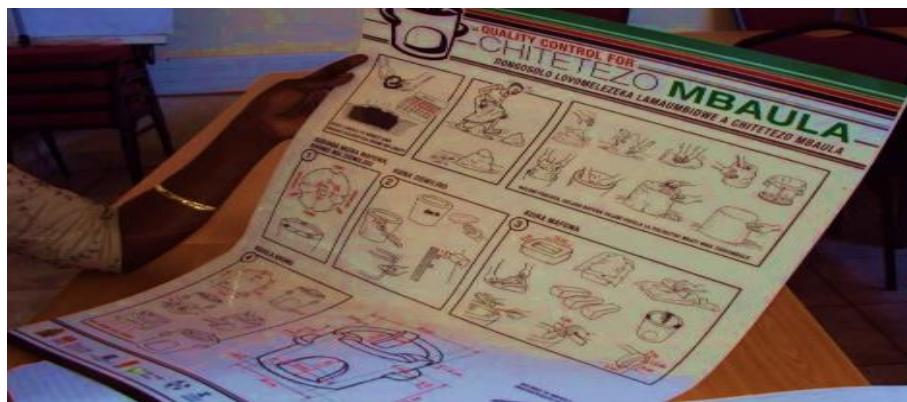
The stove production process is cumbersome; it is labour intensive, coupled with heavy and complicated instruments and tools. It takes 42 days for a stove to be ready for use. The production cycle was set as a quality control measure (Stove Camp, 2013). It was also a way of ensuring production of stoves that meet the standards of an ICS. However, there seem to be a general knowledge and acceptance that the stove would eventually crack on the upper door.

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[29] In Figure 6.1, the elements of the activity system are labelled on one activity system only to avoid crowding the diagram. This applies to all the figures of this nature in this chapter.

Photo 6.1: Stoves with a crack on the upper door of the stove from Chapita Village in Balaka district, and Mvuduma Village in Mulanje district (Chisoni, August 2014)

Photo 6.2: Quality control tool for production of Chitetezo Mbaula (Chisoni, August 2014)

The crack is affecting the subjects of the activity system. During a group interview, participants expressed concern over the crack because the crack develops despite following the cumbersome production process as indicated in Photo 6.2.

> **Stove producer 1:** *Another problem we are facing is that, after making the body of the stove, it takes us a very long time to put pot stands, and the handles, also when opening the door it takes long, perhaps we could have managed to complete putting the finishings on two stoves only since that time you arrived here.* [Approximately 4 hours] *… More also, after firing the stoves from the kiln, most stoves come out cracked.* (GP Interview # BK10)

The stove promoter emphasised how cumbersome the stove production process is:

> **Stove promoter:** *Stove production is hard work. If you have not eaten you cannot make stoves, first. When you want to make stoves, you need to have a proper meal.* (Interview # BK12)

The members of the production group did not have knowledge on how the crack develops and how to deal with it. In their explanation, sometimes the crack appears after cutting off the door of the stove, sometimes it is visible after firing the stoves and sometimes it is visible when they start making fire in the stove when cooking (see Photo 6.1 above of both used and unused stoves with a crack). This makes it

difficult to understand the source of the crack. However, they feel a pressing need to do something about the crack; at the same time it seems impossible to do anything about it (Engeström & Sannino, 2011). Members of the production group expressed this concern in few selected quotes below:

> **Stove producer 1:** *… When our customers buy the stove they tell us that the stove does not take long to crack, why is that? … And we don't know what to do to stop the stove from cracking on the door where we put firewood.* (GP Interview # BK10)

> **Stove producer 2**: *They say it is the breathing space* [expansion] *of the stove …. However, we are desperate to find the kind of knowledge needed to make that stove smooth without any crack. Our thoughts are troubled, that, what expertise can we come up with to produce a smooth stove without the breathing, in order to get rid of the word breathing? … We asked them* [Field Facilitators], *but that is the answer we get* [breathing space of the stove]. *So we do not know that from the higher level experts up to our level here, haven't they found the knowledge* [on how to deal with the crack]? (GP Interview # BK10)

The situation creates tension between the buyer (potential user) and the producers (sellers). First, when a stove cracks after purchase, the user goes back to the seller to get a replacement or money back. However, the seller fails to make a replacement since this is a tendency in almost all the stoves (see *Filed Facilitator 2* citation below and Photo 6.1 above) and because she has no explanation to offer to the user. Second, buyers pay a full amount for a cracked stove. The crack creates ambivalence in the subject of the activity in terms of how much they should sell the cracked stoves for because sometimes between 50-65% of the stoves produced in one production cycle, come out with a crack. The tension is reflected in the quote below:

> **TSF & ICS user FK:** *Sometimes they sell you a cracked stove. Sometimes the owners see that the stove has a problem, but they still sell you and the price is the same* (as the one without a crack). *So it is difficult to go back to them, because some are tough, when you tell them the stove has a crack, they say you are the one who has caused it, yet they know that the stove had a crack. The first one we bought, broke completely, we did not use it. The second one we bought also had a crack, even though we used it for some time it is because we took good care of it. Therefore, I decided not to go back* [to the seller] *because I knew I would not gain anything.* (Interview # BK5)

The crack creates user apathy in using the stove. This is reflected in the quotes below:

> **TSF & ICS user VN:** *… now that it has developed a crack we are no longer using it*. (Interview # BK4)

> **TSF & ICS user FK:** *… I just have a feeling every day that the stove would break any day …* (Interview # BK5)

The situation creates negative influences that discourages potential buyers to buy the stove since they receive the messages about the crack and the treatment others have received from the producers:

> **TSF user KG:** *Sometimes they give you a cracked stove. And when you complain they don't listen. So some of us who have never bought a stove may want to buy, but we become discouraged with the way things are happening, and we just decide to continue cooking on the three stone fire. … what else can you do, since they shout at you? … you just avoid them. Let it be.* (Interview # BK6)

Most of the stoves that I came across throughout the study in most places in the country including Mulanje, Phalombe, Balaka, Dedza had a crack on the upper door (Chisoni, 2014; Chisoni, 2015; Chisoni, 2016c). The SEMU officer provided a nuanced explanation on the cracking of the stove during a consultation meeting as follows:

> *Field Facilitator AC: The crack would still come … the crack would still come because this we say, "where the kraal is rotten." Even when we are building a house, the weight is distributed. It is like; this building the weight is distributed instead of carrying alone, because in the way the stove is designed … this place will carry the weight alone. This part will carry the weight exerted here alone. This weight will not be distributed to the whole stove because here "the kraal is already rotten." So definitely, that weight … will make this area weak. … It is the design. Even if they would bring a mould with ready-made door, as long as there is this weak point, this place would still crack.* (CM BCCLW BK6)

The SEMU officer used a local proverb to explain the probable cause of the crack. The proverb means that the hyena chooses the rotten (weakest) point of the livestock kraal (enclosure) to break into the kraal He was emphasising that the design of the stove causes the upper door of the stove to crack because it is a weak point of the stove.

Comments received at the CCC 2016 indicated that stove practitioners in the country are aware of the crack, however, the cause is not well established. Several explanations were given, such as uneven heat distribution between the top and bottom of the stove when firing, failure to comply with the number of days for soil maturation, not following the production process carefully, unsuitable clay soil used for production, etc. Most practitioners seemed to claim that it is due the unsuitable clay soil used. However, a stove expert who was also one of the organisers of the CCC dismissed the type of clay soil as a cause. She indicated that "*it is common in many places, in Mulanje, for example, most people use wire to tie around the stove*". Her final remark emphasised that *"the stove would crack entirely".* It is difficult at this juncture to point to one thing as a cause since most groups in the places I visited were facing a similar problem.

From the discussion, this contradiction manifests as a double bind, from the perspective of the subjects of the activity system. It is a secondary contradiction between the rules and the object. Even though the process as stipulated was set to ensure a quality product, and the production group follow the systematic process, the product comes out with a crack, which reduces the quality.

The rule that the production group follows is a stipulation from other activity systems that influence indirectly the activities of the production activity system, as there is no interaction between them. The activity systems were involved in coming up with quality control measure through production of a quality control poster (see Photo 6.2 above) during the Stove camp 2013 (Chisale, 2015). Among them was Concern Universal, the institution that disseminated and promoted stoves in the study area (ibid.).

Concern Universal, as an intermediary entity, translated the quality control tool into its own rules that they follow when promoting and implementing stove projects and the production group follows the rules when making stoves. The rule clashes with the object of the stove production activity system as indicated below:

6.3.2.2 Quality control rules from implementer versus production of cracked stoves on the upper door that reduces quality

The rule from the implementer activity system is clashing with the object of the producer activity system. This makes it a quaternary contradiction *(see citations from Stove producer 2 in Section 6.3.2.1 above).* This contradiction is related to contradiction in Section 6.3.2.1 above.

6.3.2.3 Selling a cracked stove at a normal price versus buying a cracked stove at a normal price

Further, the crack influences a conflict of motive within the subject of the activity system to sell a cracked stove at the same price as a stove without a crack, considering the labour of production, on one hand, and the intended outcome to make a livelihood out of stove production, on the other hand. Consequently, the buyer purchases a cracked stove at the normal price. This conflict of motive manifests in and produces tension between the subject of the production activity system and subject of the TSF & ICS user activity system, making it a quaternary contradiction. This contradiction is reflected in the discursive citation from *TSF & ICS user FK* in Section 6.3.2.1 above*.*

6.3.2.4 Between the object of producing quality energy efficient cook stoves for convenient low energy cooking and the object of convenient low energy cooking

The crack is also constraining some members of the TSF & ICS user activity system to act on their object because it is creating user apathy in using the stove. This becomes a quaternary contradiction between the object of the TSF & ICS user activity system and object of the stove production activity system (see citation from *TSF & ICS user VN* and *TSF & ICS user FK* in Section 6.3.2.1 above).

6.3.2.5 Contradiction between the demand for stoves on one hand, and the unavailability of the stoves on the other hand

There was a growing demand for stoves from local potential buyers and external buyers. Some members of the TSF user activity system and the Stove promoter activity system were looking for stoves but could not find them. One TSF user had this to say when I asked why she does not have a stove:

> **TSF user RA:** *It is because they have stopped … they have stopped making stoves … they have stopped. Maybe it has been two years since they stopped producing stoves.* (Interview # BK9)

Her response indicated that she has been looking out to buy a stove but she cannot find one because the production group is no longer producing stoves. The stove promoter substantiated the demand for stoves, on one hand, and the unavailability of stoves, on the other hand:

> **Stove promoter:** *It was last week, I had money amounting to … they wanted 80 stoves, and I still have the money for purchasing stoves, but stoves are scarce. When I call the Field Facilitators, they just tell me to wait so that they can search for stoves.* (Interview # BK12)

One of the responsibilities of the Stove promoter is to encourage production groups to produce more stoves because the demand for stoves is growing elsewhere in the country because of Government of Malawi's two million ICS target (see Chapter 1, Section 1.4.4.2). The TSF user would usually purchase a stove from the local production group within the village, yet the Stove promoter would purchase within the zone and outside the zone (see Chapter 1, Section 1.7.1.3). From the quote above, the Stove promoter failed to find stoves from either within or outside the zone and the Field Facilitators had to search for stoves for more than a week. This is a manifestation of a contradiction. I probed further to understand why this situation is the way it is using explanatory principles from CHAT and Critical Realism (see Chapter 3): the contradiction stems from defunct production groups, as well as having few members remaining in the few functional groups. This problematic situation is common in many production groups. Photo 6.3 below shows abandoned kilns due to defunct stove production groups from three districts, Balaka, Dedza and Mulanje.

Photo 6.3: Abandoned stove firing kilns in Chapita Village, Chilije Village and Robeni Village (Chisoni, August 2014)

Stove production process is risky to the bare feet and hands of the producers (Stove camp, 2013), which are among the major tools used in mixing the cob and when pressing the cob into the moulds. Consequently, production group members drop out of the production system because of the hard work involved in stove production. Chapita Village production group (under this case study) is not exceptional. Members dropped from 18 to one between 2009 and 2015. When I asked why members dropped out of the production group, I got the following responses from different activity systems:

Field Facilitator LM: … at first, it was difficult because we were … issues of marketing, issues of what… so it was difficult to market and sell those stoves at once because we were still sensitising the communities so that they should buy those stoves so, it was difficult at first. So, a lot of members pulled out from it was not only from Mmanga [Chapita], *that a lot production groups – a lot of members pulled out saying we don't see the importance of engaging in stove production because we are not getting profits on that*. (Interview # BK11)

The Field Facilitator's response indicated the problems to do with marketing of the stoves and failure to get profits from stove production. This is an example of overlooking process elements in the dissemination and diffusion of the cook stove technology as indicated earlier. However, the failure to realise profits is also connected with the price offered for a stove, which production group members bemoaned does no match the hard labour involved in stove production (see Section 6.3.2.5 below).

The production group members gave three reasons why many people dropped out of the production group. This is reflected in the citations below:

Stove producer 2: They ran away because there were reasons; some when they saw the pit when we were digging the pit for fermenting the soil, … some older ones said they will not manage, some ran away because of the pounding with the fist involved when making the stove. You know, for that stove to be smooth, it requires a lot of energy and strength for it to look beautiful. So after seeing that, some women felt that with their age they will not manage … for us [older women] *it was rheumatism, for younger women they said the work can make you age quickly.* (GP Interview # BK10)

In the above quote *stove producer 2* explained that most people pulled out of the production groups because of the hard work involved in making stoves. Members cited especially the work to do with digging of the pit for fermenting clay soil, mixing the cob with heels to detect stones, making it smooth and cracking of heels in the process (see Section 6.3.2.6 below). They also cited pounding the clay soil into the mould to make sure it settles tightly in order to produce the desired shape as expressed below:

Stove producer 1: The tools we use – the problem we were facing with the first mould [bucket mould], *is pounding with a fist, because when we are pounding, if there are pieces of wood or twigs or stones, we get scratches or wounds. When that happens it is difficult to pound again, and you wait until the wound heals. The second mould* [pedal mould] *at least we don't pound much, but we still pound on the sides, and during that process the hand still hits the wall on the other side, and if you miss, you feel pain on the hand.* (GP Interview # BK10)

In the above citation, the problem stems from the tools used in production of the stoves, which pose some risk to the producers. The second reason is expressed in the citation below:

Stove producer 1: Marketing of the stoves is a bit of a problem because when selling them locally, the customers come one at a time and after a long period. At least Concern Universal buys many stoves at once. However, selling locally is difficult. Sometimes when you are lucky, two or three people come at once to buy the stoves, at least then you are happy to have made a bigger amount of money. I feel that it is a problem. (GP Interview # BK10)

The above citation points at marketing as the reason for members pulling out. This is related to the failure to realise profits as pointed out by *Field Facilitator LM* above. The major problem with marketing is

however transportation of the stove to reach the market. The stoves are heavy; one stove weighs about 10 kilograms. Hence carrying the stoves from producers to the market becomes a problem as expressed by the stove promoter below:

> **Stove promoter:** *The problems that I face is transportation, because to carry one stove from where you are coming from at Mmanga on a bicycle you only profit MWK50 [$0.07] and the bicycle is damaged. The problem is transportation … to think of how to carry the stove. People need to see the item first to pay the money … and transport becomes a problem*. (Interview # BK12)

Concern Universal sometimes assists the producers and the Stove promoter with transport, however, they require a minimum of 50 stoves to provide transportation. Due to the other reasons explained earlier, it is difficult to produce many stoves. This exacerbates the marketing problem.

The third reason why production group members were pulling out of the group is expressed in the following quote:

> **Stove producer 2:** *The way things are … because considering how hard it is to produce a stove you cannot sell the stove at MWK350* [US$0.49]. *Many people can be demotivated and prefer to do piece work elsewhere considering the way things are* [the hard work and the low price offered]*; the work involved is hard. But I can make MWK1000* [US$1.40] *in a day, through piece work so why should I bother myself with pounding with fists, and what have you*. (GP Interview # BK10)

The third reason as expressed in the quote above is the mismatch between the intensity of the labour in stove production and the price at which they sell the stove. This becomes complex because the producers do not make the prices for their products. The price is determined by the implementer activity system (see Section 6.3.2.9). It is also influenced by government policy, which emphasises promotion of low-cost cooking technologies to ensure stove affordability for rural poor people. Since the group members do not have control over the price, they exercise their agency by pulling out of the groups. Moreover, some community members cannot afford the stove at the current price, which is low on the side of the producers (see Sections 6.3.2.5 and 6.3.2.9).

The discussion explains problems behind the pulling out of members from the production groups, which affects the production levels and cannot match the growing demand of cook stoves elsewhere and therefore it explains the scarcity of stoves. Therefore, the contradiction is manifesting through scarcity of stoves. However, going beyond the surface to understand why things are the way they are: why the production group is not producing stoves when their intended outcome is income generation, on one hand, and the potential buyers are looking for stoves, on the other hand, it is possible to see causal mechanisms influencing the contradiction and relation of connections. Connections exist from scarcity of stoves to pulling out of production group members; to the hard work involved in stove production that does not match with the price offered for the stoves and to transportation problems, and more importantly to the tools used for production. It is therefore manifesting as a critical conflict. Members of the production

group are silenced (Sannino, 2008a) because they cannot determine the price of their products to match the labour. They face contradictory motives that they are failing to resolve on their own (Engeström & Sannino, 2011): to generate income from stove production, which is labour intensive with little profit, versus pulling out and relying on piece work. This contradiction stems from advocacy for low-cost technologies influenced by poverty for rural populations in the country, on the one hand, and overlooking of process elements in the development and diffusion of the cook stove technology, for instance, formulation of market and distribution networks on the other hand (see Chapter 1, Section 1.5). The subjects cannot change the tools to aid the production process as multi-stakeholder in the ICS practice design tools. Due to tenuous interactions among the key actors as discussed earlier (see Chapter 5) the women are silenced, their voices cannot be heard (see also Chapters 7 and 8). From the discussion, the contradiction is secondary, between tools and the subject. This secondary contradiction is related to the secondary contradiction below:

6.3.2.6 Complicated production tools and hard work involved in production process versus dropping out of stove production activity

A secondary contradiction occurs between the subject and object. The available tools constrain the subject, to work on the object. The tools make the production process hard especially the use of heels to detect stones and other unwanted materials from the clay soil and smoothening the soil and the process of compressing clay soil in the mould and pounding with the fist. This results in injuries and forces members to drop out of production group, as reflected in Section 6.3.2.5's citations from *Stove producer 2*. The Stove camp report (2013) also highlights that stove production is hard work and that members should be informed from the onset about this (p. 6).

6.3.2.7 Complicated tools and hard work versus rolling out of two million stoves

A quaternary contradiction occurs between the available tools for stove production and the outcome of the policy activity system to roll out 2 million cook stoves since the available tools are contributing to reduction in stove production. This is a common phenomenon (not unique to this group) as discussed earlier (see Photo 6.3). This contradiction is related to Sections 6.3.2.5 and 6.3.2.6 above. The following quotes provide access to the contradiction:

> **Field Facilitator LM:** *And you will find that in most of the groups the people remaining from one production group, it is about a group of less than ten. It's about seven, eight, nine in every group, seven, five, six… no group has 20 people.* (Interview # BK11)

> **Stove promoter:** *… And last year only three people were producing stoves. The Chairperson produced more about 200, but the other one only 20, the other one 30 and stopped there.* (Interview # BK12)

6.3.2.8 Complicated tools and hard work versus buying and selling stoves for convenient low energy cooking

Another quaternary contradiction occurs between the tools of production activity system and the object of the promoter activity system of buying and selling stoves for convenient low energy cooking, since the stoves are scarce. This contradiction is related to Section 6.3.2.5 above and is reflected in the first citation from *Stove promoter* and *TSF user RA* in Section 6.3.2.5 above.

6.3.2.9 The need to raise the price of the cook stove due to the labour involved in the production of stoves versus promotion of low-cost cooking technologies for affordability purposes

As reflected in Section 6.3.2.5 above, the production group members complained that the price offered for the stove is very low compared with the labour involved in the production of stoves, also because the prices of basic commodities are rising elsewhere, yet the price of the stove has not been revised. This challenge was also highlighted by Developing Innovative Solutions with Communities to Overcome Vulnerability through Enhanced Resilience's (DISCOVER) presentation at the CCC 2016 (DISCOVER, 2016). For example, one needs to sell three stoves to buy a five-litre bucket of maize; yet to produce one stove, it takes 42 days for it to be ready for sell as indicated earlier. The maximum price for a stove at the time I conducted BCCLW was MWK600 (US$0.84), and the cost for a five-litre bucket of maize was MWK1, 500 (US$2.10). In Malawi, the cost of living is high. Most rural families survive on less than a dollar a day (Malawi. Ministry of Natural Resources Energy and Environment (MNREE) (2010) and World Bank (2015). Most rural families have no means of livelihood; they depend on rain-fed agriculture (Malawi. Ministry of Agriculture and Food Security (MAFS), 2012) (See Chapter 1, Section 1.4.1). In Chapita village, households rely on subsistence farming and most of them do piece work for daily survival. The production group members expressed that they saw stove production as an opportunity to make a livelihood and to be self-reliant without depending on their husbands for every need; hence, this is reflected as primary outcome from the list of outcomes for the activity of stove production (see Chapter 5). One production group member expressed concern on the price.

> **Stove producer 2:** *Our concerns are to do with the low price* [of the stove] *considering the way things are. Can you imagine selling on wholesale at MWK300* ($0.42) *per stove, and considering how hard it is to produce a stove? That is why we have been begging that they consider us on the price.* (GP Interview # BK10)

In the quote, *Stove producer 2* is begging for a price increase because as indicated earlier the production group does not determine the prices of their product. The implementer activity system determines the price. The policy activity system also influences the price in order to meet the two million cook stove target by 2020. This is reflected in the citation below:

Field Facilitator AC: That is what I said earlier that we have a target to roll out two million cook stoves by 2020, so one way to reach the two million target is that people should purchase the stoves, so if we increase the price people would not buy. That is number one. Number two is that we are responsible for determining the prices because we started the project so when we make the prices we don't just dream about any price, no, we do a gross margin analysis. … We have not done a gross margin analysis currently, but now we are planning to do a gross margin analysis because the value of Malawi kwacha has gone so low. So I can agree with them [about the producers' complaint on low price]. *… However, they should not make a new price because when they do that, the buyers would not buy and if they do not buy, they will remain with the stoves, they will not have market for the stoves. … We moderate the prices because we are the ones to look for markets. … They cannot determine prices … the stove is not yet on free trade, it is not on free trade. … We want people from the rural areas to purchase the stoves, so if the price goes very high, they* [buyers] *would not buy, the Stove promoters also would not buy, we would as well not buy the stove and they* [producers] *will remain with the stoves. That is why I am saying when we do the gross margin analysis we will release the minimum and the maximum price. However, as of now, they cannot make their own prices, not yet; we have not reached that stage*. (CM BCCLW BK6)

The stove promoter made similar observations on the selling price of the stove as expressed below:

Stove promoter: Stove production is hard work; you cannot make a stove without taking food. You need to eat properly before you go to make stoves. You also need to have body lotion because the soil makes your skin dry and chaffed; you have cracks all over, cracks all over the feet. So yes, their [producers'] *complaint is sincere, because in People's Trading Centre, they are selling the stoves for more than MWK2000 ($2.77), yet they* [the implementers] *say we should sell the stoves at MWK500 ($0.69). Yes, they can complain. Then because of financial problems, it is difficult to find MWK500 here in the village, so then the potential buyers from the community say the price should remain the same, producers are saying the amount is little.* (Interview # BK12)

The stove promoter confirmed the hard work involved and argued that since the work is hard compared to the selling price and that the stove is sold at a higher price in super stores, producers' complaints are sincere, especially also because the prices of commodities in general are rising. Then again, she contended that since the villagers do not have a stable source of income, which makes it difficult to find money, it is also sincere to complain about the price they have to pay for the stove. Some community members cannot even afford the current price:

ICS user SM: I have always wanted to have that stove that these people are producing, but it is because of what I have told you already, it is financial problems, such as money issues. However, I have always admired the stove … that is why I just decided to construct that one in the kitchen so that I cook on that, at least to be similar to those being produced, but that stove (Chitetezo Mbaula) *I wish I could buy*. (Interview # BK2)

The woman quoted above has constructed a fixed brick stove with some metal fixings in her kitchen to get to the same level with those that have Chitetezo Mbaula. In her explanation, she 'admires' the Chitetezo Mbaula, to the extent that she did not allow lack of money constrain her from owning a stove. One can look at the stove as a sign of prestige in this case; at the same time it is an expression of individual agency. The admiration for the stove triggered agency to construct a fixed stove, which was

not promoted in the study site, but she copied it from her visit in the Northern Region where one organisation is disseminating fixed type cook stoves. More importantly, her comments indicate that some community members cannot afford the stove. One TSF & ICS user also explained why she never replaced her stove when the previous one broke; in addition, a TSF user substantiated the issue in the citations below:

> **TSF & ICS user FK:** *… with the way they have raised them* [the stoves]. *When we went to ask … we were surprised that the stoves have gone so high. So I decided to go back and prepare well* [look for more money]. *Therefore, from that time I did not go back to them* [producers] *…. We are worried about the high price, for a villager to find K600 ($0.83) it is difficult. We know it* [stove production] *is hard work but the price is too much, here in the village, it is a lot of money. We are just worried, that yes we understand that the work is hard, but the price is high.* (Interview # BK5)

> **TSF user KG:** *I have never bought a stove; … money sometimes is difficult to find to buy a stove.* (Interview # BK6)

In the explanation offered from the Field Facilitator below, one can see that financial status of the community plays a major role in making decisions on whether to purchase a stove or not:

> **Field Facilitator LM:** *Basically, it's about the economic status. They would rather go for buying food than having a stove, yea so it's about economic values, nothing about this, it's about economic values. … So there are challenges, people say- some say it's expensive because it is now at K500 ($0.69). People say it is expensive to get K500 and buy that one as opposed to cook on three stone fire.* (Interview # BK11)

The Field Facilitator explained a conflict of motive that the TSF users may be facing: the need to buy a stove to save firewood, versus the need to buy basic needs such as food, which is exacerbated by the fact that the alternative traditional cook stove (TSF) is free.

From the discussion, the contradiction is manifesting as a critical conflict. Both the production activity system and the TSF & ICS user activity system express feelings of being subjugated by the stove price. The subjects of the activity systems involved face inner doubts that paralyse them in front of contradictory motives (Engeström & Sannino, 2011, p. 374). The implementers are faced with the need to implement the policy of advocating low cost cooking technologies versus attaching income generation to the activity of stove production to encourage production groups to produce more cook stoves. The production group members are faced with the conflict of motive to venture in a steady income generation activity versus the motive to drop the production of stoves and rely on piece works that involves less labour and produces better money, yet is unreliable. Similarly, TSF & ICS users and TSF users are faced with the conflict of motive to use the little money they have to purchase a stove versus the motive to feed the families. The subjects of each of the activity systems cannot solve the situation as individual units as this originates from deep-seated poverty affecting especially rural populations. Therefore, the contradiction is

quaternary between the expected outcomes of making a livelihood out of stove production and the object of implementer activity system of dissemination of low cost technologies.

6.3.2.10 The need to make a livelihood out of stove production versus economic status of end-users

Another clash occurs between the outcome of stove production activity system to make a livelihood out of stove production and the subject of the TSF user and TSF and ICS user activity systems' economic status that the low-cost technology is still not affordable by the subjects. The subject of the TSF user and TSF and ICS user activity systems are constrained to act on their object. This contradiction is quaternary and it manifests through *Field Facilitator LM, TSF and ICS user FK, ICS user SM and TSF user KG* in Section 6.3.2.9 above). The contradiction is related to Section 6.3.2.9 above.

6.3.2.11 Summary of contradictions

The figure below summarises contradictions for this section.
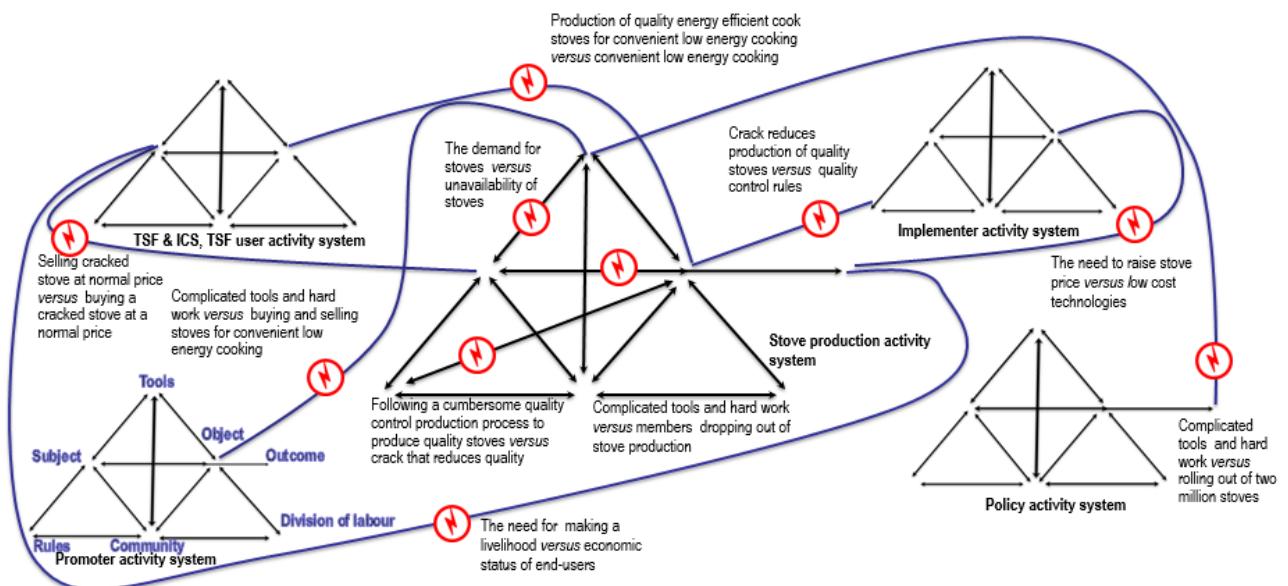
Figure 6.2: Contradictions within the stove production activity system and between the activity system and implementer, policy, TSF & ICS user, TSF user, and promoter activity systems
Source: Engeström 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.3.3 Contradictions within the implementer activity system and between the activity system and TSF user, TSF & ICS user and promoter activity systems

6.3.3.1 Scripted effective approaches for promoting ICSs versus putting the end-users on the periphery of ICS sensitisation messages

When the stove project implementers entered the project site, they targeted the production group and trained them in stove production with the help of sub-contracted trainers. However, they did not conduct any cooking demonstrations (Controlled Cooking Tests) (CCT) which the implementer recommended in

their report as having a positive influence for end user appreciation of how the stove works, creating motivation to buy the stove and influence stove uptake (Concern Universal, 2012; Stove Camp 2013). Since 2009 when they implemented the project in the study area, they have never conducted cooking demonstrations. The Stove Camp report of 2013 is silent on user training and on ways to develop approaches to get the users to use the stove, as much as it tackles development of innovative marketing strategies to improve sales and access of the Chitetezo Mbaula. Furthermore, to date there is no user-training manual developed. Yet a quality control tool for production of cook stoves is available as indicated earlier (see Photo 6.2). During a meeting with a team in the Alternative Energy Section at the Department of Energy Affairs organised outside BCCLWs, as part of the session on consolidation and generalisation of the new practice (see Chapter 7) and to share some research findings with the policy activity system, it became evident that there no user manual had been developed and that stove implementing institutions target production of stoves rather than use of stoves:

> *Energy assistant MB: The first problem as far as the usage of the stove is concerned, is maybe end user training; they provide this to the producers not to the users.* (FUW BK2)

> *Energy officer MA: OK the issue is I would like to suggest that first of all, a complete training manual- end user training manual has to be put in place, I think agreed by stakeholder. … It may also enter the report* [my report to the cook stove steering committee] *that focus also should be on usage – the use, I mean how many are using apart from just monitoring how much we have produced and distributed.* (FUW BK2)

A Project Manager from Concern Universal, also made similar remarks, that NGOs are not much concerned with usage, they usually focus on dissemination and distribution (Chisoni, 2015).

During the BCCLWs, participants made observations that many people do not know how to handle the stove, for example, where to put firewood, and how the stove performs due to lack of sensitisation. They further observed that the ways and means for sensitising potential users exist, but they lack someone to open them. In digging deeper, to understand the observations, I found that the stove production group members who usually interact with the potential users when buying and / or receiving a free stove do not have the responsibility to sensitise the potential users about the stove. (See stove production activity system, Figure 5.5.) The producer is not supposed to sensitise the user and is not trained on how to do this, because a rule from the implementer activity system stipulates that the producer should not be involved in selling the stove in order to concentrate on production to facilitate production of quality stoves (see Chapter 5, Figure 5.5). The Stove promoter is responsible for selling stoves and is the only one given the role to sensitise potential stove users and she is equipped with information and handling of stove, purpose and performance issues. However, the producers sell the stoves because there is only one Stove promoter within the zone in which the study area is and she stays about 10km from the study area. Hence, the potential buyers find it easier and more practical to buy from the producers who are

nearer. In this case, the producers evade the rule because they need to make sales and relieve the buyers from walking a long distance. As a result, they buy the stove without any proper information on how to use the stove, apart from what they learn from other end-users who also learnt from other end-users. This situation is reflected in the Field Facilitator's response below:

> *Researcher: So what about using the stove itself, do you think there are other factors apart from the issues you have talked about that would make a household fail to use the cook stove even if they have it?*
>
> *Field Facilitator LM: … some they don't see the value of using the stove because if there are no messages that have gone to that end-user about the importance of the stove, they cannot use that one. Or if we have gone with a message of 'buy a stove to get 3kgs of pigeon peas without explaining very well about the importance of those stoves, that one cannot use the stove…. People are saying get a stove is very important, without telling the end-user the importance of using that stove or say get that stove you will get an incentive without telling him the importance of that stove.* (Interview # BK11)

The quote above provides evidence that some potential users receive no sensitisation messages and some receive incomplete messages or the sensitisation message is miscommunicated to the potential users. This is an inconsistency because the Field Facilitator is responsible for facilitating the delivery of appropriate messages to the end-users, as project implementers. In the response, the Field Facilitator appears to distance himself from sensitising end-users because the role was left to the Stove promoter as indicated earlier. However, the Stove promoter fails to reach out to all potential users because she is responsible for a large zone since other Stove promoters have dropped out. In his response, the Field Facilitator appeared to be aware of the miscommunication happening around sensitisation of the stove.

This lack of sensitisation as well as failure to use the available approaches, especially the CCT is echoed in the quote below:

> *Stove producer 1: It* (CCT) *has never happened here; maybe this is the first time to make us their Stove promoters to be selling them the stoves. They have just trained us at Kachenga that we should see the difference* [between the TSF & ICS] *so that we should promote the stove in those ways.* (GP Interview # BK10)

Stove producer 1 above has been producing stoves since 2009 when the project started in the village. Yet she was trained in 2015 on how to promote the stove using CCT. The citation below provides more evidence that end-users were not properly sensitised on the concept of the cook stove:

> *Stove promoter: … when we started selling stoves, we faced problems because people were saying that the stoves would consume their firewood.* (Interview # BK12)

In the above quote, community members are reported to be saying the complete opposite of what the stove does. This shows that people were not sensitised properly on the stove. Another ICS user confirmed that the CCT or any sensitisation meetings have never happened in the village:

> *ICS user SM: No, in this village, I have never heard that there has ever been a call for a meeting concerning stoves – no it has never happened.* (Interview # BK2)

The above quote demonstrate that CCT and sensitisation meetings that target the end user have not been conducted in the study area. However, in the interviews done with the Field Facilitator, he indicated that the implementers conducted many demonstrations (CCT) and sensitisation meetings when I asked him how many CCTs demonstrations were conducted in the project area in order to triangulate the information collected from the other activity systems:

> *Field Facilitator LM: Yea there are so many demonstrations because our role model was to involve stove promoters that actually live there in the communities. … Stove promoters are the ones that go round the communities and inform or tell communities the importance of such stoves. And they conduct a lot of demonstrations. Apart from the market [CCT] demonstration, we also conduct open days for the project. … every three months we conduct one open day where we gather all communities around that GVH* [Group Village Headman], *for example, in GVH Mmanga in every three months we conduct one open day where we demonstrate how the stove is used and how that stove has been very efficient to the communities.* (Interview # BK11)

The Field Facilitator indicated that CCT are conducted in the study area, yet the previous quotes above *(ICS user SM* and *Stove producer 1)* show that CCT were never conducted in the village since 2009. He also indicated that the stove promoter is responsible for conducting demonstrations and she has conducted many demonstrations, yet the stove promoter does not conduct demonstrations. Her roles as she indicated do not include CCTs (see Chapter 5, Section 5.2.1.3. The implementers are supposed to conduct CCTs using the same pot quality, timers and foodstuffs, which are not part of the promoters activity systems tools (see Chapter 5, Section 5.2.1.3). However, in triangulating the information, the stove promoter indicated only one CCT demonstration was conducted at the Group Village Headman level. (See also Chapter 5, Section 5.3.1.1 for further evidence.) This is an example of once-off activities to technology dissemination as discussed earlier (see Chapter 2). The following illustrates this:

> *Researcher: How many times have cooking demonstrations been conducted in Group Village Head Mmanga around that place where there is the production group at* [name of a person]?

> *Stove promoter: No demonstration has been conducted around that place, it only happened at GVH* [Group Village Headman] *level.* (Interview # BK12)

> *Researcher: So how many times have the demonstration meetings been conducted?*

> *Stove promoter: Only one stove demonstration happened.* (Interview # BK12)

In the quote below, *Stove producer 1* explains how the implementers introduced the stoves in the village, which further reveals lack of sensitisation:

> *Stove producer 1: She* [the Stove promoter] *explained that I have received the message that we will receive stoves that we should buy at the price of MWK300. So, those who would want the stoves should register their names so that when the stoves come they should be called to get the stove at MWK300. So, people accepted and promised to buy the stoves.* (GP Interview # BK10).

People were expected to buy a cooking technology that they have no knowledge about, reflecting a clear top-down approach to technology dissemination. It is therefore not surprising that they were concerned that the stove would consume their firewood, revealing a lack of understanding of the concept behind the ICS design as pointed out earlier.

When I asked how the end users came to know about the stove, they indicated that they knew it from producers. An example is provided below:

> **TSF & ICS user FK:** *I only got it from the people who are producing the stoves, when they produce they sometimes tell you that I have produced stoves, that is how we know about the stoves. They just tell us when we meet them, … "I have stoves", but there is no any messages to say this and that, no.* (Interview # BK5)

In the above quote, the user indicated that she knew the stove technology from the producers when they market the stoves and not from a sensitisation meeting organised by the implementers or the Stove promoter and when she bought the stove there was no messages given alongside the stove.

Another TSF & ICS user also expressed that she did not receive any messages about the stove when I asked about what kind of message she received when she bought her stove from the producer:

> **TSF & ICS user ZJ:** *No, I can't say I was told… in my case I can't say I was told that this is how you should use the stove, no.* (Interview # BK1)

The problem with this lack of awareness on handling of the stove may have resulted in some households abandoning the stove because they may use it incorrectly; as a result, the performance of the stove is compromised. For example, some women put pieces of wood between the pot and the stove, consequently the stove produces a lot of smoke. Others expressed that they do not know that the stove's door needs to face in the direction where wind is blowing. The crack is also a good example. In contradiction 6.3.2.1 above, *TSF & ICS user VN* stopped using the stove after it developed a crack, probably she was afraid it would break, yet it was a consensus throughout the study that the stove can be used for almost three years without breaking after developing the crack. This indicates lack of interaction between the implementers and Stove promoters who have knowledge about the crack on one hand, and end-users, on the other hand.

From the discussion, the contradiction is manifesting as a disturbance indicating inner contradictions within the system. The subject of the activity is deviating from the normal scripted ways of working (Engeström, 2008) acting at variance with the object of the activity and the outcome. Despite the available tools for sensitising end-users about the stove, the subject is not using them. The contradiction stems from top-down approaches aggravated by assumptions that the end-user is out there waiting to adopt the technology without sensitising them (Simon, 2010). This is a secondary contradiction between the subject and object through to the outcome.

6.3.3.2 Contradiction between the role of Stove promoter and the role of the Field Facilitators in sensitizing the community through Controlled Cooking Tests

This contradiction relates to the one above. There is a clash between the roles of stove promoter and the subjects of the implementer activity system. The Stove promoter's roles and responsibilities do not include conducting CCT demonstrations. Additionally, she fails to reach out to all the potential users to sensitise them because she is responsible for a large zone (see Chapter 7, Table 7.1). However, it appears the interaction between the implementers and the promoter activity system is superficial. The Field Facilitator vehemently explained that the stove promoter has been conducting CCT demonstrations, yet she has not conducted any. This is a quaternary contradiction between the division of labour of the implementer activity and the division of labour of the promoter activity system (see Figure 6.3). The division of roles is unclear, while the Field Facilitator emphasises that the Stove promoter is responsible for conducting demonstrations, the Stove promoter does not mention this as one of her roles (see *Field Facilitator LM* above). Also, see quote below:

> ***Researcher:*** *You said you are a promoter, what is your role apart from selling stoves?*
>
> ***Stove promoter:*** *As a promoter my roles are … to encourage the production group to produce more stoves, buy them on wholesale, and sell them out. I should also look for customers to buy the stoves. Sometimes the production group members are demotivated, so I go and encourage them, tell them that the Field Facilitator is looking for stoves and people are also looking for stoves.* (Interview # BK12)
>
> ***Researcher:*** *So who is responsible for encouraging the users since you say your role is to encourage producers?*
>
> ***Stove promoter:*** *I am the one who encourages them whenever there is a meeting in the village, I find the opportunity to tell the women to buy stoves.* (Interview # BK12)

In the above quotation, the concern is selling of the stoves and not on demonstrating how to use the stove. This unclear division of labour limits end-users to acquire knowledge on proper handling of the stove and it constrains utilisation of the stove, which has negative implications for the achievement of the overall goals for promoting ICS.

6.3.3.3 Provision of an incentive to end-users to encourage stove uptake versus incentive constraining stove uptake and use

Pigeon peas is an incentive attached to the promotion of cook stoves. The ideal situation was to give pigeon peas worth the same amount as the stove to the buyer so that she feels as though she is getting the stove for free (Stove Camp report 2013, p. 12). This was done to increase stove uptake. Apart from the primary reason, pigeon peas play various roles in Balaka. According to the Field Facilitator, a person was supposed to receive 3 kilograms of pigeon peas after purchasing a stove. Since firewood is scarce in Balaka, pigeon peas are offered with cook stoves so that after harvesting, the stalks can be used for

firewood in order to reduce the number of firewood collection trips and amount of firewood collected within a given period:

> **Field Facilitator LM:** *We designed to incorporate pigeon peas in Balaka because we know firewood is a problem. … the stems can be used as firewood … after harvesting they can keep piles and piles of stems, even four months without getting to the forest.* (Interview # BK11)

The pigeon peas stalks provide a good source of firewood for the Chitetezo Mbaula as it requires small pieces of wood for good performance. The other use was for nutrition purposes since pigeon peas are a good source of protein. It also helps in improving the quality of soil through nitrogen fixation into the soil, among several other benefits (Tropical Permaculture, n.d.). One can also sell the surplus.

However, the five activity systems of TSF & ICS, TSF user, producer, promoter, as well as the implementer, seem to attach different values to the pigeon peas that seem to be at variance with the intended purpose. The subject of the TSF and ICS user activity system may buy a stove in order to receive pigeon peas, not for the sake of the stove and in some cases, this affects use of the stove. In the citation below, the Field Facilitator indicated that pigeon peas may have something to do with non-use of the stove:

> **Researcher:** *So how do you see the methodologies or the approaches you are using for promoting stoves in terms of facilitating use?*
>
> **Field Facilitator LM:** *… because one can buy a stove and just dump it or use it as a chair, and for here in Balaka we attached stoves for pigeon peas … Now knowing that people can be attracted with pigeon peas – so it's just let me purchase a stove for me to get pigeon peas.* (Interview # BK11)

In the quotation above, the Field Facilitator indicated that some people may buy the stove because they want to receive the pigeon peas. The following illustrates this:

> **Researcher:** *What else do you discuss with the buyers apart from advertising your stoves?*
>
> **Stove producer 2:** *So when they are buying they ask us questions, so now what is it that we are getting from these things* (the stove), *what is the benefit? What are we going to receive after this (*purchasing)? (GP Interview # BK10)

The producer in the above quote is reporting an encounter that happens when potential users are buying stoves. It shows that the user may be attracted to the incentive rather than the stove. In the quote, the user asked about an external benefit that would come along with the stove rather than the potential intrinsic benefit of the stove. This perception stems from the way the messages are communicated to the potential users as pointed out earlier (see Section 6.3.3.1). There is a disjuncture between the purpose of the pigeon peas, and the reason for attaching the pigeon peas to the stoves. The question from the potential user to the producers indicates tenuous interaction between the implementers and end users; it echoes the earlier contradiction that potential users are not sensitised. This relates to the quote below where the Field Facilitator questions how the messages are communicated to the end users:

> *Researcher: So what about using the stove itself, do you think there are other factors apart from the issues that you have talked about that would make a household to fail to use the cook stove even if they have it?*
>
> *Field Facilitator LM: … if we have gone with a message of 'buy a stove to get 3kgs of pigeon peas without explaining very well about the importance of those stoves, that one cannot use the stove…* (Interview # BK11)

The incentive is not only affecting use, but also uptake of the technology. The following quote indicates how the incentive meant for encouraging uptake is limiting it:

> *TSF user KG: So we are surprised because they say they will give us 10kgs yet they give us one cup, why is that? So somehow, we are frustrated, that in the way things are, we are not being encouraged … So sometimes, we are frustrated. Even though sometimes we have no money* (to buy the stove) *but these are some of the frustrating issues.* (Interview # BK6)

The above quote from the TSF user echoes the miscommunication as pointed out earlier, plus the lack of sensitisation on the technology to the end-user. The woman talked about 10kgs when the amount was supposed to be 3kgs. She also pointed out clearly that she was not being encouraged; hence, she cannot be motivated to purchase a stove with these kind of feelings. In trying to dig deeper to understand why things are the way they are reported, I gathered that sometimes some people, who are supposed to receive the pigeon peas, do not receive any, which indicated inner contradictions within the implementer and interacting activity systems:

> *TSF user KG: Other people produce the stoves the way they do, many stoves, and instead of selling them, they distribute them freely. When the pigeon peas arrive for distribution they keep it to themselves because the people did not buy the stoves, because they received free stoves they don't give them not even a cup. They keep all the bags of pigeon peas intended for distribution to themselves, they eat or they make a business.* (Interview # BK6)

The quotation above indicates that sometimes some producers exploit the incentive by distributing stoves freely so that they get a longer list of buyers quickly because it is more difficult to sell many stoves at once (see Section 6.3.2.5) than pigeon peas. This list is used for distribution of pigeon peas from the Stove promoter to the producer, then producers are supposed to distribute to their customers who purchased stoves from them (BCCLW BK2), but sometimes this chain was broken. Due to this, the subjects of the TSF & ICS user and TSF user activity systems feel oppressed and that they are buying the stoves only to enrich other people as explained below:

> *TSF & ICS user FK: … So we wonder whether they are encouraging us or they just take us as – I don't even know what to say, we should just advance their households because we buy the stoves but when the 20 bags of pigeon peas arrives they sell it. They don't care about us for buying their stoves … and we feel that we are making development for them. …They tell us that buy the stoves and we will give you* [pigeon peas], *making people motivated to buy stoves.* (Interview # BK5)

In the above quote, the user indicates that she was not encouraged to use the stove. She also pointed out that some people are motivated to buy the stove because of the pigeon peas. The frustrations

expressed in the quote may create negative feelings in using the stove if the user did not receive the pigeon peas. She may abandon the stove because the intended purpose was to receive pigeon peas.

During analysis of contradictions in the BCCLWs, it was clear that the purpose of the pigeon peas was misconstrued by the promoter activity system which was supposed to be more conversant with the way the system works. The Stove promoter and the producers expressed vehemently that those who receive a free stove should not get pigeon peas even though pigeon peas are included on the distribution list. The issue aroused more tension during the questioning session on analysis of contradictions during CL questioning session and many statements with manifestation of conflict of motive were produced from the producers and Stove promoters. An example is given below:

> **Stove promoter:** *… This shows that even the one who received a free stove wants to receive pigeon peas as well. So sometimes, it becomes difficult because she thinks she will receive pigeon peas, but she has forgotten that she did not buy the cook stove.* (BCCLW BK2)

> **Researcher:** *My question is, for example, you have produced 10 stoves, you have sold 4 and you have kept the receipts* [duplicates]. *How much pigeon peas would you receive?*

> **Stove promoter:** *For 10 stoves. You will write the name for the one you have given a free stove, and give her a receipt.* (BCCLW BK2)

> **Researcher:** *Does the pigeon peas for this one* [who receives a free stove] *come as well?*

> **Stove promoter:** *It comes. When the pigeon peas is delivered it goes to the producer whose stoves had defects and were not sold, and she gave them out free. She* [the producer] *is the one who receives the pigeon peas.* (BCCLW BK2)

> **Producer/stove promoter**: *…. She* [the buyer] *has forgotten that she received a free stove. Like she* [name of person] *is saying, that someone received a free stove and wants to receive pigeon peas when it comes!* (BCCLW BK2)

> **Researcher:** *Does it mean that when someone has been given a free stove is not supposed to receive pigeon peas?*

> **Producer/Stove promoter:** *No, she is not supposed to receive.* (BCCLW BK2)

> **Researcher:** *Why?*

> **Stove promoter:** *Because she did not pay any money.* (BCCLW BK2)

In digging deeper during analysis of contradictions in the BCCLW, I found that sometimes the pigeon peas did not reach their target because sometimes the Stove promoter would receive fewer bags of pigeon peas than what had been delivered by the Field Facilitator. As a result, there was shortage of the pigeon peas compared to the list of beneficiaries. The pigeon peas were diverted and delivered to either the Group Village Headman or a Lead Farmer, where the Stove promoter collected them. Yet the two people were not actors in cook stoves. When the Stove promoter queried the Field Facilitator, she was advised to ignore the issue:

Researcher: Do you have evidence that the Field Facilitator heard the story [that people were saying you were selling pigeon peas]?

Stove promoter: Yes, I have evidence. Then it was also found that some bags of the pigeon peas delivered at the Group Village Headman were missing. Then I asked the Filed Facilitator, 'you said that you heard people saying I sell pigeon peas, why is it that some bags are missing from that place you delivered the pigeon peas?' … so this year the pigeon peas came in December, I received a call from a Lead Farmer from Kalambo village to go and get pigeon peas for the stoves. When I went there I asked him how many bags he had received, and he said 11, and I called the Field Facilitator to crosscheck how many bags he had delivered, he said 13. … when I told the Field Facilitator that I only got 11 bags, he told me [mentions her name] *"leave it as is", and I left it.* (BCCLW BK3)

The discussion shows that the incentive intended to motivate people to buy stoves in order to increase uptake is limiting the intended purpose. It also creates user apathy in using the stove; hence, it affects use, due to frustrations with the way the incentive is distributed. There is miscommunication between the implementer activity system and that of the TSF and ICS user and TSF user activity systems about the purpose of the pigeon peas in relation to the stoves. Similarly, the producer activity system and the Stove promoter activity system manipulate the situation, which they attributed to the hard labour involved in stove production as indicated earlier, and especially because marketing of stoves is difficult compared to marketing pigeon peas. When they give out the stoves, they are sure of generating a long list of buyers, and therefore receive more kilograms of pigeon peas. This provides a window to inner contradictions within approaches used in dissemination of cook stoves within the activity system.

The contradiction has wider implications. It stems from poverty within the communities. TSF and ICS users, TSF users, promoters and production groups are looking for means for survival and tend to look for immediate benefits from the development project that will provide them with solutions to their immediate concerns, such as food. Firewood saving, to protect the remaining forests, becomes a secondary benefit.

Similarly, there are traces of corruption practice around the incentive between the Field Facilitator, the Group Village Headman and Lead Farmer. The Group Village Headman and Lead Farmer receive pigeon peas, when they are not intended beneficiaries. In addition, the Field Facilitator's actions are at variance with the intended purpose of the pigeon peas; when he is informed of the missing bags, he does not follow up. This is not unique for the pigeon pea incentive, it is not uncommon in Malawi where donor-driven projects or relief items tend to enrich the ones in the top positions instead of assisting the people suffering on the ground (Afriem, 2015; Ngwira, undated).

From the discussion, therefore the contradiction manifests as a conflict. There are also examples of conflict of motives within the producer activity system. Subjects of the stove production activity system

produce stoves to sell and make livelihood versus making stoves and distribute them free to get pigeon peas and sell the peas instead. Another conflict of motive occurs within the subjects of the TSF user activity system between buying the stove to receive pigeon peas to satisfy the immediate basic need of food versus buying the stove to save firewood, which serves both an immediate and long-term benefit. It is a primary contradiction within the tools. The incentive as a tool for encouraging uptake of stoves is constraining uptake as well as use. It aggravates into a secondary contradiction as discussed below.

6.3.3.4 Incentive as a tool versus object of dissemination and promotion of cook stoves for convenient low energy cooking

A secondary contradiction occurs between the tool and the object. The tool meant to facilitate uptake is constraining the object to transform into a desired outcome (see *Field Facilitator LM* citations in Section 6.3.3.3 above).

6.3.3.5 Incentive to promote uptake of cook stove versus user apathy in using the stove

A quaternary contradiction occurs between the tool of the implementer activity system and the subject of the TSF and ICS user activity system where the tool is creating apathy to use the stoves (see Figure 6.3). The contradiction is manifesting through *TSF and ICS user FK* and *Field Facilitator LM* citations in Section 6.3.3.3 above).

6.3.3.6 Incentive to promote uptake of cook stove versus user apathy to purchase a stove

Another quaternary contradiction occurs between the tool of the implementer activity system and the subject of the TSF user activity system (see Figure 6.3); the tool is creating apathy in the subjects to purchase stoves and it affects uptake *(TSF user KG* citations, Section 6.3.3.3).

6.3.3.7 Summary of contradictions

The figure below summarises contradictions for this section

270
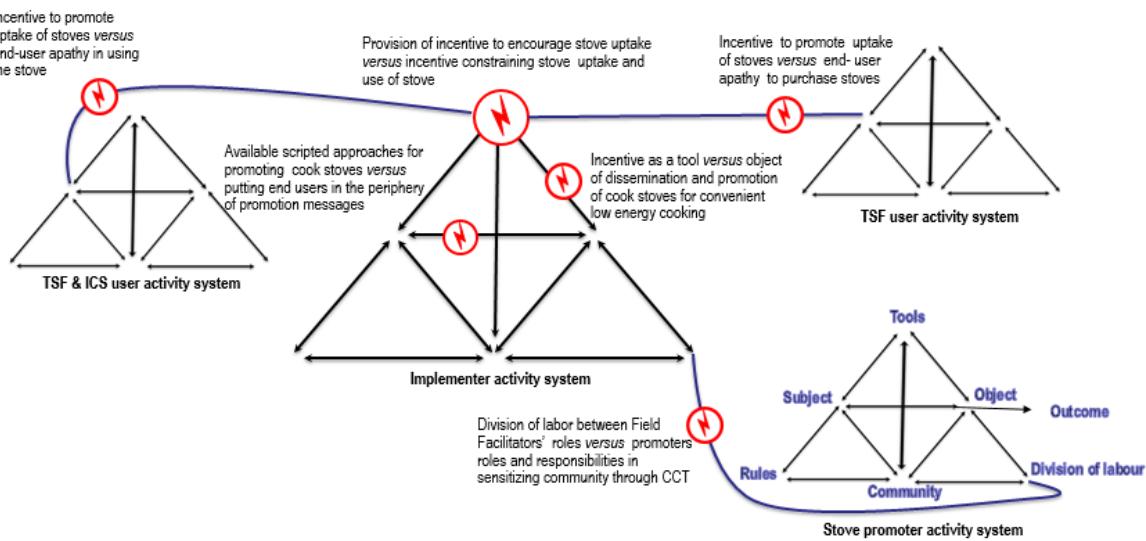
Figure 6.3: Contradictions within the implementer activity system and between the activity system and TSF user, TSF & ICS user and promoter activity systems
Source: Adapted from Engeström 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.3.4 Contradictions within the policy activity system

Contradictions in this activity system were identified and analysed from interviews with the previous Deputy Director of the Department of Energy Affairs (DoEA), the generalisation meeting with Alternative Energy section, under DoEA, documents such as the Government of Malawi Cook Stove Program Road Map (2014), and the 2003 National Energy Policy for Malawi. It is important to note that there was no direct interaction between the policy and the other activity systems, except for the implementer activity system.[30]

6.3.4.1 The need to address environmental concerns through the improved cooking technology versus putting the end user training on the periphery of stove programme activities

This contradiction relates more to contradiction 6.3.3.1 above. The Government of Malawi has the agenda to roll out two million cook stoves by 2020 in order to address deforestation, climate change and health concerns (see Chapter 1). A National Cook Stove Steering Committee was established out of the national cook stove taskforce to look at broader issues and policy issues in order to make progress in the ICS industry (Chisoni, 2015). The steering committee is a lead implementing agency (GoM, 2014). Notwithstanding that, and coupled with the release of a Road Map document, and other documents guiding the ICS programme nationally, no policy stipulates how implementers of the ICS projects in the country should operate in order to promote utilisation of the technology. As pointed out earlier, the focus

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[30] The secretariat of the National Cook Stove Steering Committee was the implementer activity system, Concern Universal.

of the implementers and the policy seem to target and concentrate on production rather that utilisation of the stoves (see Sections 6.3.3.1 and 6.5.2.5). This is echoed in the citation below:

> *Researcher: As a policy maker, is there any kind of policy or strategy that has been put in place to motivate especially the users to utilise the stove?*
>
> *Deputy Director: No at policy level I think we haven't done, because I think it's difficult to introduce something at that level maybe the academia can come in or the research because that is what I was talking … I was just mentioning at him* [secretariat to the National Cook Stove Programme steering committee] *that … I have the view that the people that have adopted these stoves are not using them 100 percent. It's either just part time or maybe they are using in conjunction or rather in addition to the three stone fire, so … I think we have a challenge, which we need to look into. So the question am saying are those stoves that we are promoting really worth what we are claiming? Because normally when you talk with those people* [potential users, *they give you all the advantages. Now the question is are those advantages what they are experiencing or is what they have been told by the promoters? If this is what they* [potential users] *have seen, why are they not using them* [the stoves]? *I was saying, maybe we need to adopt what others are doing – what type of stoves and adapt them to the local conditions or maybe we need to really engage these people* [the potential users] *and really find out what it is we can really do to the stove for them to like them. ... so, that is a challenge and it cannot come as a policy but maybe we can get partnership from the research, the academia and look at it.* (Interview # BK13)

The staff from the Alternative Energy Unit within the Department of Energy Affairs substantiated this during the consolidation and generalisation meeting (see Section 6.3.3.1 for evidence).

The quote from the Deputy Director above indicated that no strategy has been developed at the policy level that can facilitate user training or engagement with end users to facilitate utilisation of the stove. This begs the question as to how the government would make progress in climate change adaptation and mitigation efforts through the cook stove technology when utilisation is in jeopardy. This gap is also reflected in contradiction 6.3.3.1 above. The Deputy Director questioned how sensitisation messages are delivered to the end users among other things. However, the government through the Department of Energy Affairs has no operation guidelines in the way NGOs should implement the cook stove projects in the country, which seem to have a lot to do with what is happening on the ground in cook stove implementation approaches used by project implementers. This has something to do with donor-driven projects that government seem to have no control over, as reflected below:

> *Researcher: What would be your comment in terms of challenges faced, for example, when donors are pulling out without achieving their goals?*
>
> *Deputy Director: … there are terms and conditions prescribed by the donors, maybe targets to be made, which are done at the expense of both quality as well as the adoption. At times it's just prescribed, with this amount of – we want a thousand stoves produced, whether they are of good quality or not, that's another thing, whether those are adopted, it's another thing, to them that is done. So, at policy level there's nothing we can do, and we have done nothing.* (Interview # BK13)
>
> *Researcher: It's really not possible to influence?*

Deputy Director: *No, it's not possible because they are affiliated to several other bodies.* (Interview # BK13)

To a greater degree, NGOs are implementers of government policies. For example, government has an agenda to roll out two million cook stoves and it has set strategies to achieve the objective. One example is the development of the Cook Stove Programme Road Map document. The NGOs have responded to this in their project implementation and have focused on establishing stove production groups to increase production. Similarly, as the agenda on facilitating utilisation is silent at policy level, gaps in facilitating utilisation or developing strategies that engage end-users in a learning process of the technology are evident in the way the NGOs promote stoves (see Section 6.3.3.1). The absence of a strategy to encourage utilisation of ICS stoves at the policy level, influences the way project implementation is happening on the ground.

The contradiction is manifesting as a double bind. From the Deputy Director's citation, there seem to be a pressing need to offer a technology that satisfies the end-user needs and to engage with them deeper to understand their needs to facilitate utilisation of the stove. At the same time, there seems to be a perceived impossibility of action, on how to do this, which could be influenced largely by over-reliance on donor support in development projects (see Chapter 1). There are also examples of disturbance in the form of failure. There is a perceived failure to come up with a policy that fosters utilisation of cook stoves in order to realise the outcomes of the activity, such as reduction of deforestation. The contradiction is a secondary contradiction between the outcomes and rules; there are no rules regulating the operation of stove implementers to bring out the intended outcomes of the activity.

6.3.4.2 The involvement of multi-stakeholders in the National Cook Stove Steering Committee versus the absence of clear roles and responsibilities in the implementation of the activities of the National Cook Stove Programme among the multi-stakeholders

The Ministry of Energy Affairs through the Department of Energy Affairs is the chair of the National Cook Stove Programme steering committee. It is policy oversight body and the lead implementing agency reporting to the Renewable Energy Technical Working Group (GoM, 2014). It includes cooperating partners such as the private sector, Civil Society Organizations, and Development partners (ibid.). It also includes prominent government stakeholders such as the Departments of Forestry, Environmental Affairs, the Ministry of Health, Malawi Bureau of Standards, etc. and the academia such as University of Malawi, Mzuzu University and Lilongwe University of Agriculture and Natural Resources (ibid.). Within the Road map document, roles and responsibilities were stipulated for various management activities. Part of the steering committee's roles and responsibilities are quoted below from Road Map document:

The Steering Committee will be responsible for making management decisions relating to the initiation, direction, review, and closure of this programme [Road Map programme] *as well as related programs. The Steering Committee will make key decisions at designated decision points during the running of the programme, or as necessary when critical issues are raised by the Program Management Office.* (GoM, 2014, p. 25)

However, during interviews with the Deputy Director of the DoEA, he made statements that indicated the presence of inner contradiction within the division of labour in the activity system in several responses to various questions as reflected below:

Researcher: *Do you think there are any other knowledge gaps in terms of the improved cook stove in Malawi, the industry itself?*

Deputy Director: *… no knowledge gap I think there isn't, … I still blame the academia and the research institutions who were not proactive.* (Interview # BK13)

In the above quote, the Deputy Director appeared to blame the academia for not performing their roles as given in the Cook Stove Programme Road Map document. However, in a follow-up question, I needed to understand how the Department of Energy Affairs as the chair of the National Cook Stove Programme Steering Committee is engaging the academia in the cook stove programme; his response indicated that he was not sure of the chair's mandate as well as the mode of operation of members within the steering committee:

Researcher: *So how has your Department of Energy been able to engage these academics if it's been possible?*

Deputy Director: *We have tried to engage them through the National* [cook stove] *Task Force, but so far … we haven't attained the results. … but maybe, but now is it [it's] them that either they need to be coming to us, or them are possibly doing it on their own and then present to us?* (Interview # BK13)

In the above quote the Deputy Director is not sure how they are engaging the academia; he is questioning on who is supposed to do what in terms of where the mandate should come from. Yet the Department of Energy affairs are the decision makers responsible for "initiation and direction of the programme" (GoM, 2014) as indicated earlier and the academia are within the steering committee. Further, I needed to know what his comments were on the future of cook stove industry in Malawi:

Researcher: *So what would be your comment on the future of the cook stove industry in Malawi?*

Deputy Director: *I have already said there is need for proactiveness by our researchers and academia. They need to do more find out the reasons then adopt or develop technologies, develop the ones that are existing to meet the people's appetite. So, at the policy level there isn't much we can do because it's the people that are suffering, and that are locally made materials, so there isn't much we can do because energy is a necessity, so there isn't much we can do on the policy.* (Interview # BK13)

From the quotation above, one questions the roles and responsibilities of the policy, especially given the Department's role as the chair of the National Cook Stove Programme steering committee that has its object and outcome of rolling out two million cook stoves nationally by 2020. In the citation, it is not clear how they are working as a steering committee in terms of distribution of roles and responsibilities, and how they are making decisions towards the achievement of the object of their activity. The citation also appears to indicate a laissez-faire approach to the cook stove programme as a national initiative that is responding to climate change, deforestation, and indoor air pollution, which unfortunately is coming from the policy activity system. However, without implementing comprehensive policy changes, renewable energy and energy efficiency will never realise their full potential (Sovacool, as quoted by Geels, et al., 2015, p. 31).

From the discussion, the contradiction is manifesting as a dilemma through the statements of the Deputy Director and in conjunction with the mandate of the steering committee as stipulated within the National Cook Stove Programme Road Map document. On his own, the Deputy Director's statements indicate incompatible evaluations about the cook stove programme. For example, he indicated that there is no knowledge gap in the cook stove practice, yet he appeared to blame the academia for not conducting more research and developing technologies that "meet people's appetite." He indicated that "people are suffering" probably from diseases that are caused by pollutants from smoke, yet one of the activity system's outcome is to address health issues that affect people cooking with biomass indoors. The contradiction is primary within the division of labour (see Figure 6.4). It appears that the inclusion of the academia in the steering committee is superficial, as they are not practically in the committee, for example, the Deputy Director indicated that he does not know whether the academia as the members of the steering committee "need to be coming to us" (the Department of Energy as chair of the steering committee). As a result, they are not "proactive" in developing technology that satisfies the end-user. The contradiction aggravates into a secondary contradiction below.

6.3.4.3 No proactive researchers and academia to develop technology that satisfies end-users versus expected outcomes

A secondary contradiction occurs between the division of labour and the outcomes of the activity (see Figure 6. 4) which can only be realized if end-users utilise the stoves. The contradiction manifests through citations below:

> **Deputy Director:** *I have already said there is need for proactiveness by our researchers and academia. They need to do more find out the reasons then adopt or develop technologies, develop the ones that are existing to meet the people's appetite.* (Interview BK 13)

Deputy Director *… there are terms and conditions prescribed by the donors, maybe targets to be made, which are done at the expense of both quality as well as the adoption. At times it's just prescribed, with this amount of – we want a thousand stoves produced, whether they are of good quality or not, that's another thing, whether those are adopted, it's another thing, to them that is done. So, at policy level there's nothing we can do, and we have done nothing.* (Interview # BK13)

6.3.4.4 Summary of contradictions

The figure below summarises contradictions for this section.
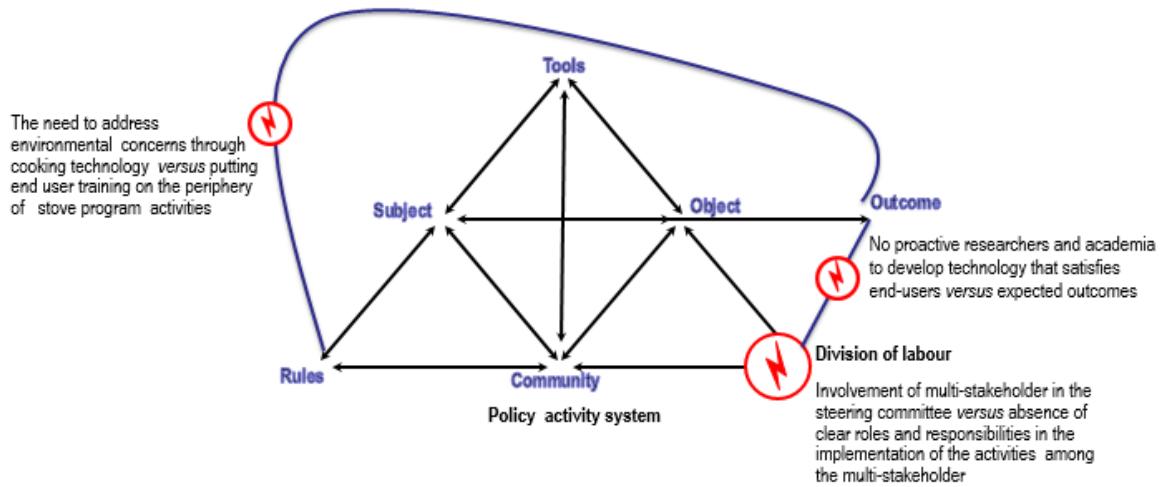
Figure 6.4: Contradictions within the policy activity system
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.3.5 Summary of contradictions in Chapita Village case study

The contradictions identified in Chapita Village case study are summarised in Figure 6.5 below. In Appendix 22, I provide the summary in a table to show clearly the three levels of contradictions identified.

The need to address environmental concerns through cooking technology *versus* putting end user training on the periphery of stove program activities

Tools

Subject

Object

Outcome

Rules

Community

Division of Labour

Policy activity system

Involvement of multi-stakeholder in the steering committee *versus* absence of clear roles and responsibilities in the implementation of the activities among the multi-stakeholder

Complicated tools and hard work *versus* rolling out of two million stoves

The demand for stoves *versus* unavailability of stoves

Complicated tools and hard work *versus* members dropping out of stove production

No proactive researchers and academia to develop technology that satisfies end-users *versus* expected outcomes

Production of quality energy efficient cook stoves for convenient low energy cooking *versus* convenient low energy cooking

Stove production activity system

Complicated tools and hard work *versus* buying and selling stoves for convenient low energy cooking

Promoter activity system

Following a cumbersome quality control production process to produce quality stoves *versus* crack that reduces quality

Selling cracked stove at normal price versus buying a cracked stove at a normal price

The need for making a livelihood *versus* economic status of end-users

The need to raise stove price *versus* low cost technologies

Firewood saving & heat retention of the stove *versus* delaying cooking (no speed in cooking)

Delay cooking *versus* saving firewood as outcome

Stove delays cooking *versus* convenient low energy cooking

Stove design versus struggling to cook nsima

Crack reduces production of quality stoves versus quality control rules

Design of stove not adapted to cultural preferences versus addressing environmental problems

The need for making a livelihood *versus* economic status of end-users

Incentive to promote uptake of stoves *versus* end- user apathy to purchase stoves

Between outcomes: speed of cooking, and low firewood use *versus* reduction of deforestation, reduction of indoor air pollution

Provision of incentive to encourage stove uptake *versus* incentive constraining stove uptake and use of stove

Incentive as a tool *versus* object of dissemination and promotion of cook stoves for convenient low energy cooking

TSF & ICS user activity system

TSF user activity system

Incentive to promote uptake of stoves *versus* end-user apathy in using the stove

Available scripted approaches for promoting cook stoves *versus* putting end users in the periphery of promotion messages

Implementer activity system

Division of labor between Field Facilitators' roles *versus* promoters roles and responsibilities in sensitizing community through CCT

Figure 6.5: Summary of contradictions in Chapita Village case study
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

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6.4 Contradictions in Waziloya Makwakwa Village case study

Four activity systems were identified within the Waziloya Makwakwa Village case study as indicated earlier. They include implementer activity system, stove construction activity system, ICS user activity system, and TSF user activity system. In this section, I present and analyse the contradictions identified within the activity systems.

6.4.1 Contradictions within the implementer activity system and between the activity system and the TSF user activity system

6.4.1.1 The requirements for constructing the fixed type stove in a kitchen to address indoor air pollution, promote sanitation and hygiene versus unclear procedure for initiating and promoting kitchen construction

The fixed stove promoted in the study area has a chimney, which is required to reduce smoke in the kitchen as one way of addressing indoor air pollution. Due to this, the stove is constructed against a wall to allow drilling of a hole for the chimney (see Chapter 1, Photo 1.5). This requires a kitchen that is constructed with bricks or clay soil, which the implementers refer to as a 'standard' kitchen. The stove cannot be constructed in a kitchen made of grass, sacks or plastic walls. Additionally, the sanitation and hygiene components of the Integrated Community Development project require that the stove be constructed in a kitchen. However, the majority of households in the study area do not have kitchens. A few households have kitchens made of grass walls and other materials. The construction materials for the 'standard' kitchens are readily available in the community, but kitchen construction is problematic because of division of labour at household level since kitchen construction is a shared activity between men and women. For example, the woman is responsible for cutting grass for roofing and bringing it home and drawing water for construction, while the man is responsible for making bricks and building the kitchen and cutting poles for roofing as well as roofing. However, women are left to take care of most domestic chores because men have a tendency to spend time drinking beer. This tendency is affecting kitchen construction as reflected in the two quotes below. In addition, the two excerpts indicate that division of labour between a husband and wife affects construction of kitchens:

> **Researcher**: *Why is that some people do not have kitchens?*

> **Stove constructor 3**: *It is laziness especially for men. Early in the morning they are drinking beer ... they don't care about doing domestic chores at home, they leave it for us women, they say since we are women … if she does not do it, she is the one to suffer with the children. … As for the kitchens, you have to talk several times, the woman should talk about it several times until you quarrel, and that is when they* [men] *would start constructing a kitchen.* (GP Interview # MZ7)

> **Researcher**: *Why is that some people do not have kitchens, what do you think could be the reason?*

> *ICS user LJ: For me I think it is just laziness, men are lazy … It is the men who are lazy.* (Interview # MZ1)

The absence of kitchens in most houses is also attributed to the traditional practice that allows a married son and his wife to share a kitchen and cook together with parent in-laws. Two major reasons were given for engaging in this practice. First, that the whole family shares the food items the sons bring at home. Second, mother in-laws want to be relieved from domestic chores, especially cooking and washing dishes, which becomes the responsibility of the daughter in-laws. This could mean that three or more families would be cooking on one stove depending on the number of sons one has. It is a deep-seated celebrated tradition practice among the Ngoni in this area and it means most people do not construct kitchens and in turn, do not construct a stove. This also contributes to slow stove uptake in the study area. It also has implications for the sustainable consumption of firewood since, when it comes to space heating, each house does this separately in their own kitchen on an open fire. The absence of kitchens explains the low level of stove uptake in the study area as indicated in the following excerpt:

> *Researcher: So what is the major challenge that you meet in promoting the cook stove in that area?*

> *Field Facilitator FC: … like I said, when we started the project, we found … no kitchens, so that one also delayed in terms of adoption* [of stoves]. (Interview # MZ10)

Against the contextual information presented above, and despite the significance of the kitchen in the implementation and promotion of the ICS project, there were no guidelines on how to promote kitchen construction in the implementation of the stove component because the guidelines were absent in the project document. Paradoxically, the project seemed to have concentrated more on stove construction, which was however affected by the absence of kitchens in most households. For example, the implementers organised training sessions for volunteers in stove construction, took them for exchange visits to learn how to construct the stove and set up a clear procedure on how to carry out stove construction (Chisoni, 2015; see also Chapter 5, Section 5.4.4). Yet there was no procedure to facilitate construction of 'standard' kitchens as part of the implementation of the stove project, which was supposed to be the first phase of the project. In the excerpt below the project officer explained how the stove project and procedure for promoting construction of kitchens was absent in the project document:

> *Project Officer: The stove project just came as a cross-cutting issue under environment. However, it never had guidelines on how to carry out the implementation, no. They* [guidelines to promote kitchen construction] *are not in the document* [project document. (Interview # MZ8)

The implementers did not develop a procedure to facilitate kitchen construction. This situation has prevented other households from constructing a stove (see Section 6.4.2.4 below). From the discussion, the contradiction is manifesting as an inconsistency. The project document stipulates the agenda for addressing indoor air pollution, sanitation and hygiene through kitchen construction, among other things;

yet the approach for achieving kitchen construction is absent. It is a primary contradiction within the tool. The contradiction stems from "successful project syndrome". By this I mean, copying a project from another area because it was successful without engaging in contextual analysis of the target project area before project implementation. The Field Facilitators acknowledged that they did not take into account the differences in socio-cultural context of the project area when they implemented the project, because it was successful in another area. In other words, diffusion of the stove innovation was done without the process of "disembedding, travel and reembedding" (Geels et al., 2015, p. 24). The process entails "abstracting core characteristics of an innovation in one location into general lessons which then can 'travel' to other locations, where their application will require adjustments to accommodate local specificities" (ibid., p. 24, single quote emphasis in original text).

6.4.1.2 The need for hygiene and sanitation versus "no kitchen no stove" rule

Another primary contradiction occurred within the rules. The requirement for provision of a stove that should meet the following criteria: address indoor air pollution, promote sanitation and hygiene and improve wind shield was converted into a rule: "no kitchen no stove" (see also Section 6.4.2.4). By emphasising the rule on the part of the implementer activity system, and by abiding by the rule on the part of the TSF user activity system, the very purpose of sanitation and hygiene is defeated since many houses are still cooking outdoors. The following quotes give access to the contradiction:

> **Researcher:** *I have also learnt that the stove should only be constructed in a kitchen, what is the main reason for that?*
>
> **Project Officer:** *The major reason why we want the stove to be in a kitchen not outside is hygiene and sanitation, because when the stove is outside the person will be hit by sun, at the same time dust will be entering in the food.* (Interview # MZ8)

From observation data, and the foregoing discussion, many houses in the study area do not have kitchens, and in turn, they do not have a stove (see Chapter 5). The Project Officer also made the following remark to support the observation:

> **Project Officer:** *Because when we started with the baseline survey, we found that many people had no kitchens. Only few people had kitchens, maybe approximately 20 percent had kitchens. And for those who had kitchens they were shacks. But our plan is that a household should have all the things ... when you have a kitchen you should construct a stove. Now the data that we have gathered shows that some houses have stoves some do not have.* (Interview # MZ8)

The contradiction is manifesting as a double bind. The implementers feel that they need to promote hygiene and sanitation while promoting low consumption of firewood; however, it appears impossible to accomplish this because the majority of households are cooking outdoors.

6.4.1.3 Scarcities of major stove construction materials versus strength-based approach to project implementation

A quaternary contradiction occurs between the tools of the TSF user activity system and the tools of the implementer activity system that of strength-based approach (see Figure 6.6). There are pulling forces between the scarcity of *ndhulani* and cow dung, which are local materials and the requirement for using locally available materials, as one characteristic for the strength-based approach. Additionally, there is need for money in exchange for the cow dung, which was initially perceived as locally available and free:

> **Field Facilitator FC:** *… when you are coming to the community people expect a lot, but our project much focuses on the strength based approach, we are using strength based approach. What are the resources that we have, what are the strengths that we have as a community? Because sometimes we are looking at development when it comes whether it's government or NGO, we feel that now we are going to see* [what they are bringing], *but ourselves we don't want to give, but let's focus on the strength we have, the resources, the assets that we have. That's why that stove you look on it, all materials are locally available.* (Interview # MZ10)

However, as pointed out earlier, the materials are not locally available. Additionally, owners of the cow dung demand money for the cow dung, or sometimes they demand that the women graze the cattle in exchange for the cow dung. This is because they use the dung for fertilisers in their gardens.

> **Participant MP:** "When we go to ask for cow dung, some cattle owners tell us to pay some money since the stove will be benefiting us. Some say we should graze the cattle. That is why we do not have stoves."[31] (BCCLW MZ3)

> **Participant DC:** *It is because they use the cow dung for other things, they put in the garden because sometimes they do not have fertiliser, … so they know that if they just give anyhow, then they will deplete the manure. Therefore, instead of refusing to give you, they tell you to graze the cattle in exchange. So for us women we become discouraged when we think of grazing cattle.* (BCCLW MZ3)

The contradiction manifests through a conflict of motive within the owner of the cattle and the TSF users. This conflict is between use value and exchange value. Traditionally and essentially, keeping of cattle is for the owner's enjoyment from the products; on the other hand, rearing cattle demands time and money and the price of fertiliser is expensive. A conflict of motive occurs within the owner of the cattle between giving cow dung to the potential stove users in exchange for money or grazing cattle and keeping it for fertiliser. Another conflict of motive happens within the subjects of the TSF user activity system between the need for cow dung for stove construction and the requirement to graze or pay some money in exchange for cow dung to construct a stove.

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[31] The quotes with inverted commas are reported speeches. Participants were given a task to find the root causes of the contradictions analysed in the previous session during a BCCLW session (see Appendix 14). They conducted interviews with some community members and were reporting to the participants of the BCCLW what they found.

6.4.1.4 Summary of contradictions

The figure below summarises contradictions for this section.
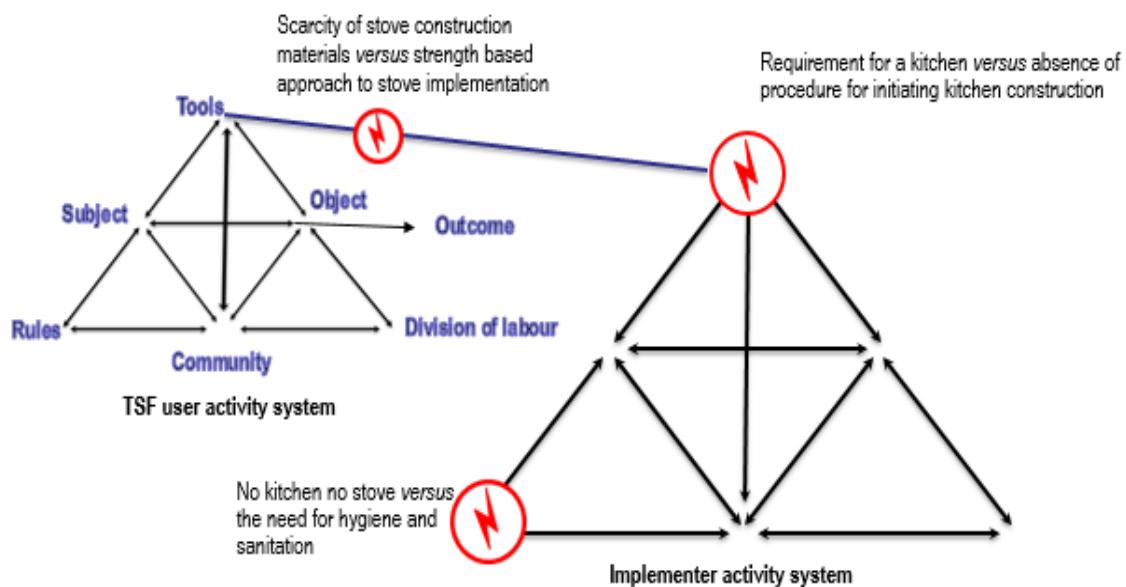
Figure 6.6: Contradictions within the implementer activity system and between the activity system and the TSF user activity system
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.4.2 Contradictions within the TSF user activity system

6.4.2.1 The need for ndhulani*, a stove construction material responsible for durability of the stove versus the scarcity of the material in the project area*

Geographically, the study area is not favourable for ndhulani; it is usually found in marshy areas, yet the project site is high land, as a result *ndhulani* is rare. The situation is aggravated because of the growing demand from stove construction, as well as the amount required for one stove, which is one full 20-litre bucket (Chisoni, 2016a, p. 54; see also Chapter 1, Table 1.3). Since the project's inception, which was 14 months by the time I collected data, only a few houses had constructed a stove, yet activity systems began to experience problems concerning the scarcity of the material. TSF users had problems finding *ndhulani*; they had to cover between 13 to 16 kilometres for a return trip to search for *ndhulani*. This is a paradox because one reason for the stove intervention in the area is to reduce time spent in search for firewood due to long distances covered as firewood is found in farther distances due to the diminishing of the mountain forest (Chisoni, 2015; Chisoni, 2016a).

The scarcity of *ndhulani* is one of the main contributors to TSF user apathy in stove construction. This is because they have to collect all the required materials for stove construction and then inform the stove construction group to go and build them a stove. This is evidenced in the following quotes:

> **TSF user EC:** *… it discouraged me because I did not find* ndhulani*, so I decided that I should pay those people who know how to construct the brick one.* (Interview # MZ3)

> **Project Officer:** *… The long distances people have to cover searching for the soil could be one contributing factor* [limiting a person from owning a stove] *as people may feel reluctant to cover such distances only to get soil, and they may feel that it is better they continue cooking the same way* [on the three stone fire]. (Interview # MZ8)

In the two citations above, the scarcity of the material and the long distances to be covered in search for *ndhulani* are factors contributing to user apathy in stove construction. Moreover, the problem is slowing stove construction, which affects uptake of ICS as reflected below:

> **Stove constructor 3:** *… if it* [ndhulani] *was plenty, we could have reached 30 stoves in this village, but because the soil is hard to find, we are lagging behind.* (GP Interview # MZ7)

From the foregoing discussion, the contradiction manifests as a double bind. It is a primary contradiction within the tool of the activity system. The mediating artifact is shared between the TSF user activity system and stove construction activity. The subjects of the TSF user activity need to search for all the stove construction materials in order to have a stove constructed, and the construction group requires the mediating artifact to accomplish the activity of stove construction (see Chapter 5). Consequently, the unavailability of the tool is constraining the subject of both the TSF user activity system and stove construction activity system to work on their objects. Since the contradiction is shared in the two activity systems, I will not discuss it under the construction group activity system to avoid repetition. It also relates and negatively affects the realisation of the object of the implementer activity system, as indicated in Section 6.4.1.3 above.

6.4.2.2 TSF user apathy in stove construction versus object, convenient low energy cooking

The primary contradiction within the tool aggravates into secondary contradiction between the subject and object. It manifests through citations from *TSF user EC* and *Project Officer* in Section 6.4.2.1 above.

6.4.2.3 The need for cow dung a material used in stove construction versus the shortage of cow dung in the project area

Cow dung is one of the stove construction materials responsible for retaining heat in the stove; hence it helps in reducing the consumption of firewood when cooking. Because of the heat retained, the stove can also function as a food warmer, instead of making a new fire to warm food. To construct a stove, one full 20-litre bucket of cow dung is required. Cow dung is also used as manure in the study site gardens. However, few people in the area own kraals (cattle enclosure) and those who have kraals keep few cattle. Due to this, some people walk long distances to find cow dung. In addition, when ICS potential users request free cow dung for stove construction, sometimes the owners demand money because they need it for manure. Sometimes the women are told to graze the cattle in exchange for the cow dung as

described above. Nevertheless, customarily men graze animals, when this happens the woman has to continue the search for the dung in a different household. Moreover, there is a traditional belief that prohibits a woman to enter a cattle enclosure when she is menstruating (see citation from *Chair project committee* below) which may constrain women from collecting the stove construction material and it exacerbates the effect of the already scarce material.

> **Field Facilitator FC:** *… there is that cow dung which is required there, so it's not all that they have in the house. That calls for some households to – don't have* [the stove], *and if they require that one* [cow dung] *they* [owners of kraals] *demand some* [money] [participant makes non-verbal signal with fingers]. (Interview # MZ10)

In the above excerpt, the Field Facilitator indicates that not all households have the cow dung and this is why some households do not have the stove. He also alludes to the condition for money in exchange for the cow dung. The requirement for money in exchange for a major material responsible for high energy efficiency in the ICS is a major concern for the implementer activity system because of the strength-based approach they use for project implementation (see Section 6.4.1.3 below).

The following interactions between the Project Officer and the Chair of project committee show that the long distance covered searching for cow dung and cultural barriers concerning collection of cow dung, may explain the few numbers of stoves constructed so far:

> **Project Officer:** *… in this area not many people are rearing cattle, there are only few, so to search for – what is deterring* [the construction of stoves) *may be is also the long distance covered to collect cow dung because there are very few cattle kraals in this area when we count. Which means it is possible for one to cover about six to seven kilometres to find cow dung. And then the distance is doubled on coming back. … there are also cultural barriers.* (Interview # MZ8)

> **Chair Project Committee:** *Sometimes you may enter the kraal when you are menstruating and if there is a pregnant cow in the kraal, it will miscarry. In addition, some people construct their kraals with charms, and when you happen to go round the kraal when you are menstruating, you never stop menstruating.* (Interview # MZ8)

The long distance may contribute to TSF user apathy in collection of the material and is a contributing factor to slow stove uptake. The situation described creates obstacles in as far the collection of stove construction materials is concerned, especially because more stove materials are required to make a stove as observed below:

> **TSF user FN2:** *I do not have a comment, but I just wanted to thank you for encouraging us with your coming, because when you asked whether there are things that discourages us* (from having a stove), *yes there are. It is to do with the labour involved in looking for this material, that material and bring them; it is also a source of discouragement ...* (Interview # MZ4)

The manifestation of the contradiction is through dilemma as well as a double bind. The example below condenses this:

Field Facilitator FC: … *it's like replacing we don't have* ndhulani*, you have to increase soil from the ant hill. In addition, I have to increase number* [amount] *of cow dung, but if they don't have cow dung, that also is a major problem that one. … because it's the cow dung that promotes keeping the stove heat for a long time, so if they don't have, yea it can make, but not to the standards.* (Interview # MZ10)

From the discussion, the contradiction is primary within the tool of the TSF user activity system, as cow dung is a mediating artifact for stove construction. The contradiction is twofold, shared between the TSF user activity system and the stove construction activity system. In that regard, I will not discuss this contradiction within the stove construction activity system to avoid unnecessary repetition.

6.4.2.4 Following the rule "no kitchen no stove rule" versus the object of convenient low energy cooking

This contradiction relates to the contradiction above (see Sections 6.4.1.1 and 6.4.1.2). The TSF user activity system adopted a rule of 'no kitchen no stove' within their activity system from the implementer activity system as discussed earlier. The quote below indicates how the rule is constraining stove construction:

Stove constructor 1: … *because if you have no kitchen you cannot construct a stove … Where will you construct it? Because the stove requires to be erected against a wall like that one. … Some do not have stoves, we have not constructed them the stove because some do not have a kitchen, when they build the kitchen then we will construct them a stove.* (GP Interview # MZ7)

Some construction group members had no stoves, when I asked why this was the case, they gave the kitchen rule as the cause. Some stove constructors are TSF users, and some are ICS users. This illustrates how the kitchen rule constrains TSF users to work on their object. The exchange below provides access to the contradiction:

Researcher: You say you do not have a stove?

Stove constructor 2/ (TSF user): No. (GP Interview # MZ7)

Stove constructor 1: We are building that one for him. (GP Interview # MZ7)

Researcher: Why are you building now when you are a stove constructor yourself?

Stove constructor 3: He had no kitchen. (GP Interview # MZ7)

Researcher: All this time?

Stove constructor 2: Kitchen. (GP Interview # MZ7)

Stove constructor 1: He had not constructed a kitchen. (Interview # MZ7)

Stove constructor 3: He only had a shack. (GP Interview # MZ7)

Stove constructor 2 (TSF user): I just moved from that area, I just settled here and I was building a house, and I had not yet built a kitchen, but now I have constructed a kitchen and I want to build a stove. (GP Interview # MZ7)

The contradiction is secondary between rule and object, since the rule is constraining the subject to work on the object.

6.4.2.5 The need for a kitchen before a stove versus the division of labour in kitchen construction

Another primary contradiction occurs within the division of labour. There is a clash between distribution of roles among the community of the activity. As a result, the subject is constrained to work on the object. The tension stems from the rule of "no kitchen no stove". The tension occurs between the subject and the members of the community. The responsibilities for kitchen construction is shared between men and women (see Section 6.4.1.1). However, as discussed earlier, evidence shows that women (despite that it has been taken as a norm) do most domestic chores. Nevertheless, when women need a stove, they put pressure on the men to take their part in kitchen construction. This results in tension especially between the wife and husband in the distribution of roles, as regards kitchen construction:

> **Stove constructor 3**: … *As for the kitchens, you have to talk several times, the woman should talk about it several times until you quarrel.* (GP Interview # MZ7)

> **Participant EC:** … *"It is because of my husband, I admire a kitchen. We can mould bricks very well to construct a kitchen, but when someone comes looking for bricks he sells them." … it is because of my wife, I built a kitchen … but she does not collect grass for thatching, and when the rain comes the roof leaks as a result the kitchen falls so I become discouraged to build again."*[32] (BCCLW MZ3).

6.4.2.6 Summary of contradictions
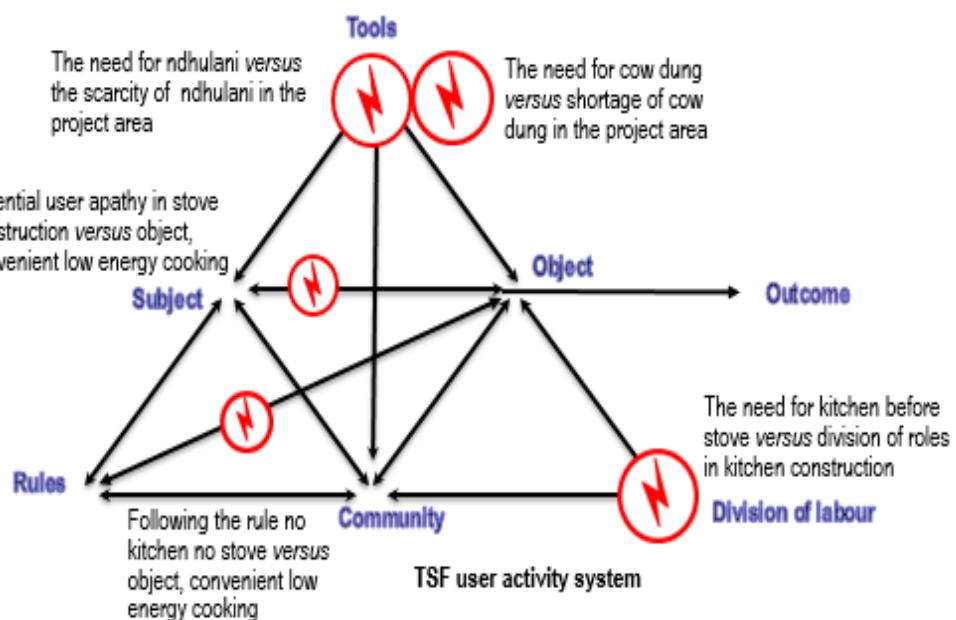
Figure 6.7: Contradictions within the TSF user activity system
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

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[32] This is a reported speech (see Footnote 31 for the explanation).

6.4.3 Contradictions within the ICS user activity system and the old form of practice activity system

6.4.3.1 The need for heat retention to achieve the requirement for fuel efficiency versus generation and emission of too much heat

The stove was designed to retain heat in order that the end-user can use less firewood for cooking, at the same time use the stove as a food warmer without putting more firewood on the stove, as mentioned above. However, the stove is retaining and generating too much heat, which in turn burns dishes and scorches pots. ICS users expressed that the stove is burning pots in the following talk turns:

> **Stove constructor 2:** *Can I say something; it* [the stove] *scorches pots.* (GP Interview # MZ7)

> **Stove constructor 3:** *Yes scorching of pots. When you leave for few minutes, you find that the pot is scorched; only the middle part is scorched. Beans burn even when you have water in the pot.* (GP Interview # MZ7)

The two interlocutors above express that the ICS burns pots and dishes. However, it is only the middle part of the pot that is scorched. This could result from direct heat to the pot because it is not open. One of the principles for ICSs is improved heat transfer to the pot, which reduces fuel requirements (see Chapter 1, Section 1.4.3). However, it appears that the heat transfer may be too much. During BCCLW session on questioning and analysis of contradictions, participants echoed that the stove produces too much heat regardless of following proper measurements and that it is a common problem:

> **Participant DM:** *You know in the way we researched on the problem almost all the people we interviewed said all the stoves are burning food and scorching pots. So, does it mean that we did not follow proper measurements when we constructed in all the stoves? Among the people, some follow exact instructions and measurements that you taught us. … but three quarters of us who have stoves –- three quarters complain that the stoves burns relish and scorches pots.* (BCCLW MZ3)

Moreover, there seem to be no heat regulating mechanisms for the stove. For the traditional cook stove TSF, one usually removes firewood and charcoal to reduce the heat; however, for the ICS stove, that mechanism seems not to work. The ICS user below explains how the burning happens:

> **ICS user LJ:** *The heat coming from the soil can make you scorch pots most times because you think that the fire is out, and you relax, and think let me put a little water. However, the heat from the soil makes the pot to continue boiling and then scorches the pot.* (Interview # MZ1).

> **ICS user RS:** *When you go around, maybe you delay a bit, on coming back you will find that it* (the pot) *is scorched because the heat is too much in the stove.* (Interview # MZ6).

From the citations above, a number of factors could be causing the burning. It may be due to too much heat transfer to the pot, or it may be due to the soil's retention and generation of heat because of the materials used in constructing the stove. The questions created the need to carry out expansive learning where participants of the BCCLW deliberated to find the origin of the problematic situation and modelled

solutions for it (see Chapter 7). The citations also indicate how difficult it may be to regulate the heat, as the burning occurs after the fire is out, which gives the impression that heat is reduced making it difficult to time the cooking on the ICS. Usually when women leave their pots on fire, they put enough water and estimate the firewood they put against the water remaining in the pot, as well as against the time they will be away. The woman would go to complete other domestic chores, such as drawing water, etc. whilst the pot is on the fire especially for dishes that take long to cook such as beans, free-range chicken, etc. In the explanations provided, it appears this kind of working may be compromised because of a lack of heat regulating mechanism on the ICS.

From the discussion, the contradiction is primary; it resides in the tool, the stove as a mediating artifact for the activity of cooking. Within the tool, two elements are pulling in opposite directions. The stove needs to retain heat to reduce the amount of firewood used; at the same time it is too hot even after fire is out. Further, it is making cooking problematic. This primary contradiction aggravates into the secondary contradiction below:

6.4.3.2 Convenient cooking versus scorching of pots and foodstuffs

From contradiction 6.4.3.1 above, it is possible to see that the tool is affecting convenient cooking. The cooking is not as convenient in that one has to be closer to monitor the pot. The subject of the activity is constrained to complete other domestic chores, as it is within the lifestyle of women, especially rural women to do a number of chores at the same time, because of problems with division of labour as indicated earlier. The contradiction is manifested in the citations under section 6.4.3.1 above, particularly from *stove contractor 3* and *ICS user RS*. (I have referred to the quotes here to avoid repetition). The contradiction is secondary between the tool and object.

6.4.3.3 The need for saving firewood, promoting sanitation and reduction of indoor air pollution versus the need for space heating and family gathering

The fixed stove type promoted in the study area consumes half of the wall of a kitchen in most cases because the kitchens are small (see Photo 6.4 below, and Chapter 7, Photo 7.11). Sometimes, depending on the direction of the door, which is a requirement to consider when constructing the stove to allow smoke to get out through the chimney, the stove leans against two walls. In that case, one length and one width side of the stove leans on the wall but in some cases, it leans on one wall. Hence, the space left for gathering around fire for heating is on two sides and on three sides respectively (see Photo 6.4 below). Usually the spaces are not enough for a family to gather around especially for large families. When a family is large, the stove is longer and wider because the pot sizes determine the size of the stove, especially the length. It is designed in a way that the three pots leave space for each other so that

when one is cooking on the three spaces at once, the pots can be placed without touching each other (see Photo 6.4 and Chapter 7, Photo 7.10). This consumes more space. When it comes to space heating, the stove divides the family into two; the mother and father stay in the kitchen, while the children make fire from crop residues outside. This has negative implications on the tradition of gathering around the fire, which has implications for building social relations within the family and extended family members. The citations below give access to the contradiction:

> **Stove constructor 1:** *There is a problem when you have a stove in the kitchen, you know some of us with families, the children do not fit around* (the stove) *and don't get the heat, as you know we are used to gather together the whole family like this* [the interlocutor uses non-verbal signal], *yea. So there is a problem.* (GP Interview # MZ7).

An ICS user explained how the fixed stove is isolating the children from the parents:

> **ICS User LJ:** *You know with this stove and this coldness, the stove only provides heating for the father and the mother, not children; it has only two places. The father stays where we put the log, the mother comes besides the father. So where would children warm themselves? With the coldness, the children here at my house gather crop residues and twigs and warm themselves there. … As for my husband and me, we stay in the kitchen just the two of us. They* (the stove constructors) *even construct two chairs for two people only.* (Interview # MZ1).

From the discussion, the contradiction is within the tool mediating the activity of cooking, which is also used for space heating, as the design of the stoves does not meet the many cultural and social uses of cook stoves and fire in the study area. It is therefore a primary contradiction. This contradiction is related to the tertiary contradiction below:

6.4.3.4 The use of stove for space heating and social interaction around fire versus the use of stove for cooking to save firewood, achieve hygiene and sanitation

A tertiary contradiction occurs between the old tradition of gathering around fire and the new tradition practice brought in by the fixed stove type, where the tool separates the subject and the dependents within the community of the activity system. The use of the stove for space heating disintegrates the family by creating a barrier to social interaction that takes places around the fire between family members, especially parents and children. The subject of the activity faces conflict of motive between using the stove for space heating in order to save firewood and, in so doing, break the tradition of gathering around fire versus use of TSF for space heating and consuming more firewood. It is manifesting as a critical conflict. In the two quotes from *ICS user LJ* and *stove constructor 1* in Section 6.4.3.3 above, the interlocutors' expressions are filled with guilt-ridden and neglect feelings towards the children, yet the situation described is unsolvable by the subjects themselves due to the design of the stove:

Participant EC: *This means that we will be only two people in the kitchen and the children will be outside with this coldness. It means that we have not respected the children's rights.* (BCCLW MZ3)

Participant MN: *That stove has a problem for us with many children because it leans on a wall and there is no space for children to warm themselves, it is only a space for the mother and father.* (BCCLW MZ3).
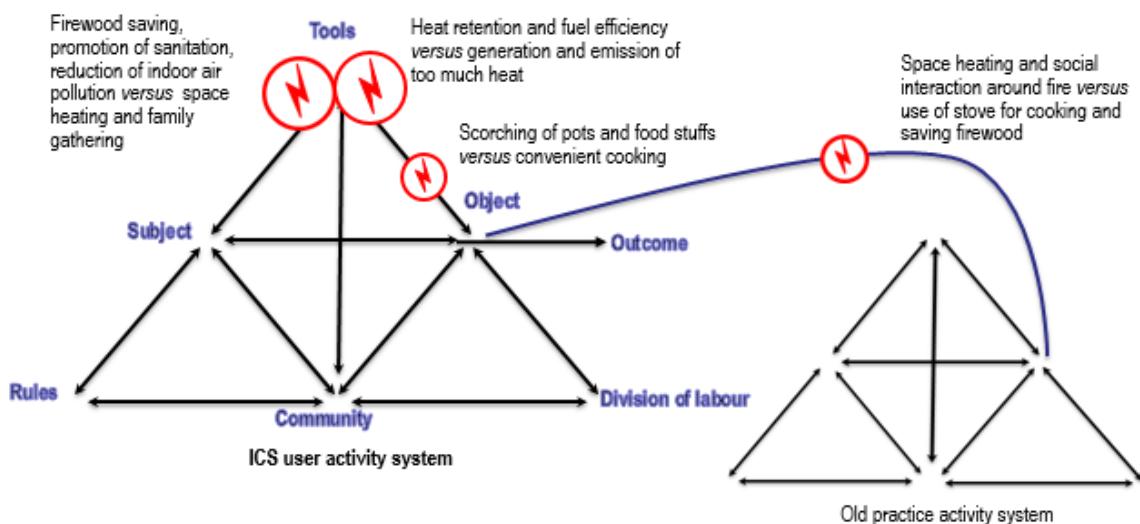
Field Facilitator AK: *When only the mother and the father stay in the kitchen, the children will not be intelligent and it will look as if we are isolating them.* (BCCLW MZ3).

Photo 6.4: Fixed ICS leans on two sides, and one side of kitchen walls (left), small kitchen (right)

In Photo 6.4, the kitchen is attached to the house. The kitchen is the one with open door.

6.4.3.5 Summary of contradictions

Figure 6.8: Contradiction within the ICS user activity system and the old practice activity
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.4.4 Contradictions within the stove construction group activity system and between the activity system and the implementer activity system

6.4.4.1 Stove construction activity as a voluntary work versus income generation activity

The stove project was introduced in the study area as free. This was done to ensure that the poorest would have access to the stoves, in line with government policy of promoting low-cost technologies for affordability by the rural poor people followed by implementing institutions. Members of the community volunteered themselves to join stove construction. At the beginning there were more members including men; however as time went by, some members stopped showing up for the stove construction activities completely. This situation puts pressure on the few members remaining; especially women because stove construction is labour intensive. Women bemoaned that when they mix cob, they lack the energy, yet there is no money to purchase food.

> **Stove constructor 3:** *… there are times when we do this work we feel hungry, the problem is especially when we have started mixing the cob with feet, we become weak and want to eat something , but there is nothing to eat. It is difficult to ask the owner of the house to cook us nsima because we do not want to look like we are begging, it can make them not to call us again in future, because they would think, those people demand food for the work.* (GP Interview # MZ7)

The situation above was aggravated because they did not have a committee for the stove construction group, due to the structure adopted by the disseminating institution that has a project committee for all the projects they disseminate in the project area. As a result, they do not know how to organise themselves to contribute money or share roles amongst themselves. Initially the women did not see this need since they felt that it was simply voluntary and there would be no ways for raising money. The Field Facilitators also instructed them that the activity was free and that they were not supposed to charge for stove construction, as reflected in the quote below:

> **Stove constructor 3:** *One time people from across the river wanted to hire us, they said we would give you money. However, that time we did not know that there should be a secretary or chairman, because we thought that even if we have a secretary* [treasurer] *what would they keep? Because we were instructed that we should not charge the activity, … that there should not be money involved. So that confused us, since they said we would just be helping one another, there was no sharing of any responsibilities such as secretary, chair, of our stove construction group. That is why we did not have the idea* [of sharing responsibilities]. *Now we see that this problem continues; we are stuck in the ground. … If we had responsibilities such as chairman, secretary, treasurer sometimes we could know that this can help us in this way; we have worked, we should eat and rest and continue* (working). (GP Interview # MZ7)

In the quote above, *stove constructor 3* indicates that people from outside the CADECOM project area admire the stoves and they request assistance from the construction group. However, it is problematic due to the few members remaining in the group and the resultant pressure of work. Additionally, the distance to be covered to do the work outside the project area, which is also not within their mandate, is

long. It also becomes difficult to consider constructing stoves for people who never participate in the CADECOM project activities. Despite the difficulties raised, members were of the view that they would still go and construct the stoves if they charged a fee. Below is an example of such views in the following speech turns:

> **Stove constructor 1:** *It is because it is free.* (GP Interview # MZ7)

> **Stove constructor 2:** *… but if we were making money…* (GP Interview # MZ7)

> **Stove constructor 1:** *… we would have constructed them* [end-user]) *stoves for the entire village.* (GP Interview # MZ7)

These issues trigger conflicts of motives in the construction group members. The first conflict of motive is between constructing stoves for non-CADECOM project members and to people outside the project area and charge a fee versus rejecting the request, and deny others the benefit of having a stove to protect the environment. The second motive is between doing the work as a skilled volunteer and have no means to generate income for buying food during the stove construction activities versus generating income out of the expertise they have for a livelihood. The conflicts of motives are reflected in the excerpts below:

> **Stove constructor 2:** *We do not see any benefit, but protecting the environment.* (GP Interview # MZ7).

> **Stove constructor 3:** *How can you teach us so that we should be motivated and have more energy so that we should get organised to construct* [stoves] *for our friends those who request us from farther places? How can we get organised so that when they request us we should be organised, because we have the expertise in these things* [stove construction]. (GP Interview # MZ7).

From the discussion above the contradiction manifests as conflict of motive, double-bind and dilemma. The dilemma-based situation is expressed through statements reflecting conflict of motive from the subjects of the activity. At the same time, they feel a pressing need to do something about their situation, for example, they observe that they are stuck in the ground at the same time they acknowledge that some of the problems could be solved if they had shared responsibilities, yet they are constrained to do that. The contradiction is primary within the subject of the activity system. This primary contradiction aggravates to a secondary contradiction below:

6.4.4.2 The rule of no cost to be charged for stove construction versus *the subjects' motive to generate money*

The construction group members need money to facilitate construction of stove activity especially purchasing food, as well as for extending construction of stoves to neighbouring areas for income generation. However, they are constrained by the rule of "no cost to be charged for stove construction". The access to this contradiction is reflected in Section 6.4.4.1 above, especially from *stove constructor*

3. This contradiction stems to stem from poverty and lack of activities to earn a livelihood. The secondary contradiction is between rule and subject.

6.4.4.3 The implementer tool of voluntary work in stove construction versus the need for income generation for supporting the stove activity and income generation to support families

One approach adopted by the implementer activity system in the implementation of cook stove project is the use of volunteers that belong to clubs. The volunteers are taken from vulnerable groups in the community. For example, some may be living with HIV, or taking care of orphans, or may be very poor. Within this approach, they stipulate that no cost should be charged for stove construction (see Section 6.4.4.1) in order to make the technology accessible to all community members. However, as indicated earlier, the subjects of the stove construction activity system need money to support the stove construction activity and engage in stove construction as a source of livelihood since they have the expertise in stove construction. A quaternary contradiction occurs between the tool from the implementer activity system and the subjects of the stove constructor activity system. There are opposing forces between the need for the stove construction to be voluntary and free versus the need to support the stove construction activities and members' households. This contradiction is related to and influenced by contradiction 6.4.4.1. The contradiction manifests as critical conflict. The members of the stove construction express feelings of being silenced. See below:

> *Field Facilitator FC: … when we are involved in our project we do not charge that is why even though some people want to receive money, some think that it will delay the progress of the project because the message was already spread that in Ehlonipeni area stoves will be constructed for free …. If they can construct stoves outside our project area, they can charge, no problem. But in our project area charging will be problematic.* (BCCLW MZ2)

> *Researcher: Why?*

> *Field Facilitator FC: It is development. Moreover, we want to help all people. After all these stove constructors did not ask for training; we demonstrated how to construct stoves and this group picked it up quickly and we would like them to help us to teach more people, our plan is, if there are many groups and they are working, we will reach our target and objective.* (BCCLW MZ2).

> *Researcher: Is development always free?*

> *Field Facilitator FC: To us it is free.* (BCCLW MZ2)

> *Researcher: Or is it because of the approach you are taking?*

> *Field Facilitator FC: No, It depends with the project we are implementing … but for this project, everything we are implementing is free, not to be charged. … Because with the way things are in Malawi, for someone to find money it is difficult.* (BCCLW MZ2)

> *Participant DC: The problem that make us stove constructors to speak like that* (to require some money for stove construction) *is that we have a group, but only three people may come for stove construction. So we have too much work especially when we start mixing the cob and making a ball, carrying and smashing it on the spot where we are constructing the stove, but there is nothing*

to eat and it becomes difficult to tell our friend [the owner of the stove] *to give us food. I am one of them who was approached by some people from our place. They hired us and told us they will give us some money, that is when we felt it would be good if we had chairman, treasurer and secretary so that when we go to construct stoves and we are in need of something, we can buy some food because when we start constructing around 1:00pm we finish at dusk. It means we have not done any household chores, yet there is nothing to benefit, and we realised that this could not work. The second thing is that some people admire to have a stove but they have problems to collect construction materials as we have pointed out. Some have spent almost a year since they collected some of the materials but they are failing to collect the remaining … but it becomes difficult for us to help them because it is free. Then how do we see that what we learnt is making sense and we are progressing with the project?* (BCCLW MZ3).

6.4.4.4 Summary of contradictions

The figure below summarises contradictions in this section.
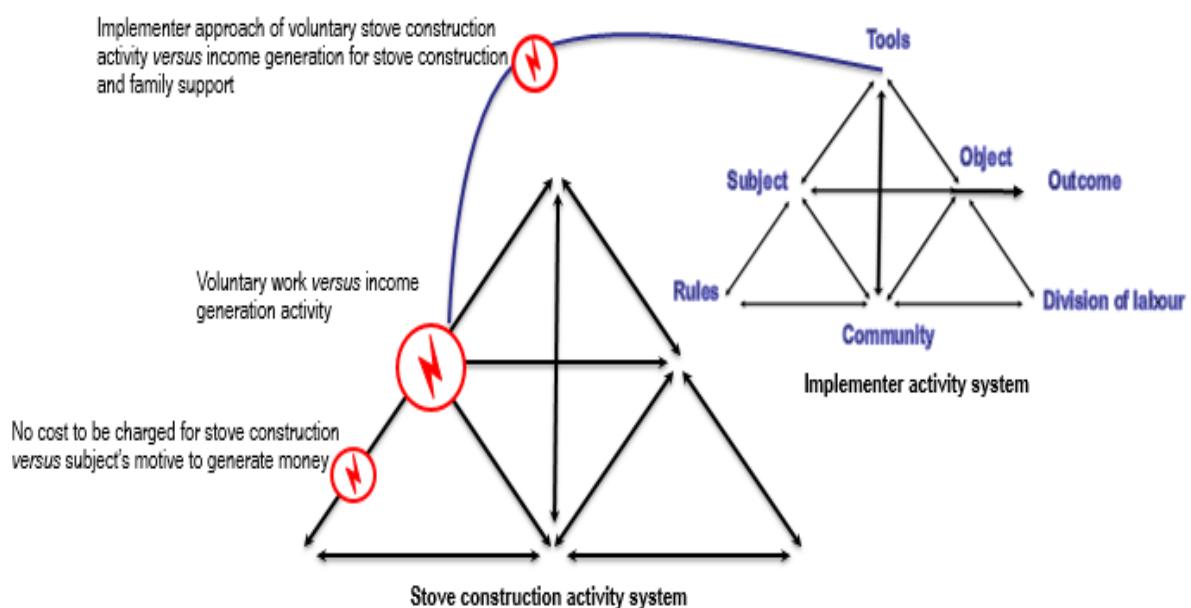
Figure 6.9: Contradictions within the stove construction activity system and between the activity system and the implementer activity system
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.4.5 Summary of contradictions in Waziloya Makwakwa Village case study

The contradictions identified in Waziloya Makwakwa Village case study are summarized in Figure 6.10 below. I provide the summary in a table (see Appendix 23) to show clearly the four types of contradictions identified.
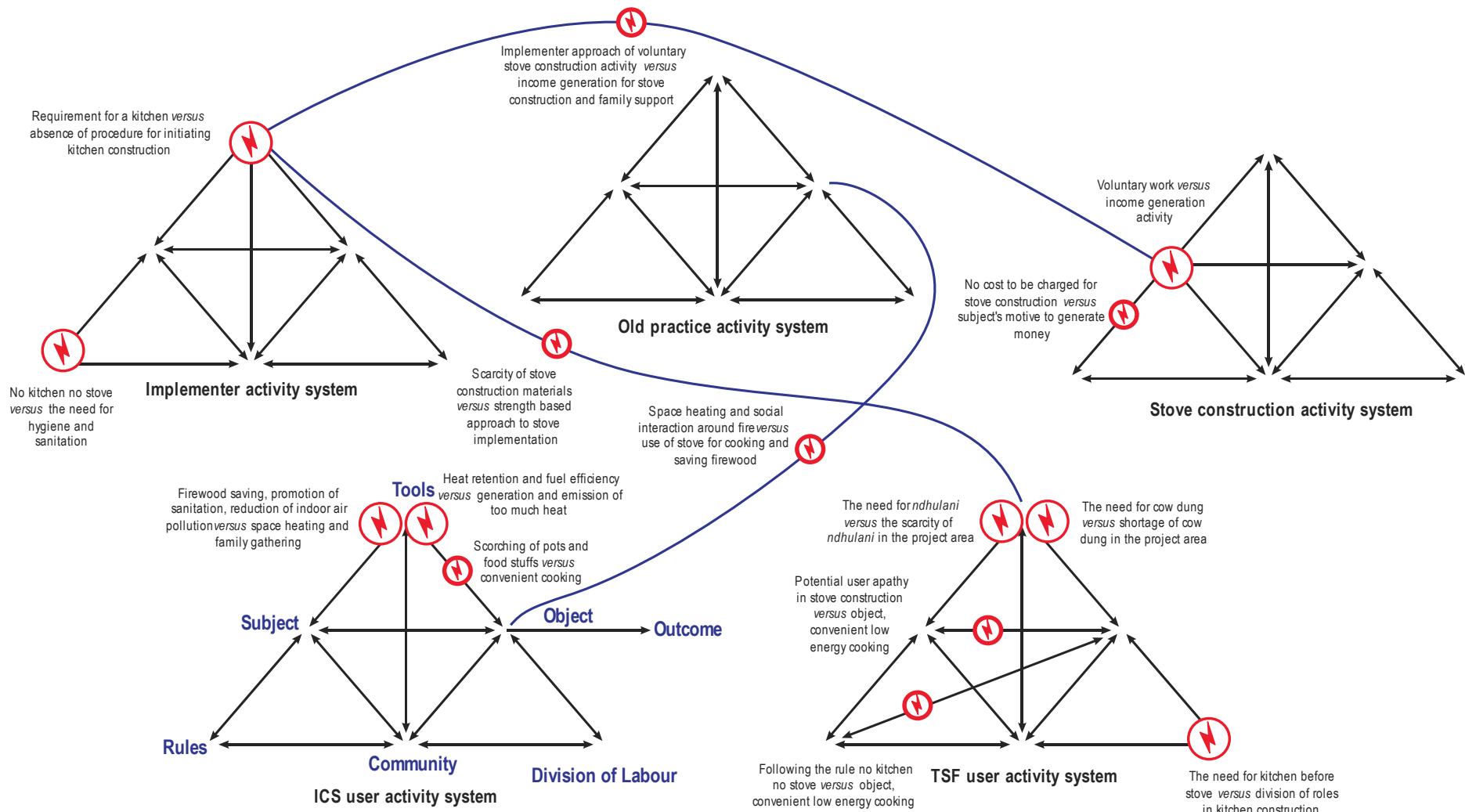
Figure 6.10: Summary of contradictions in Waziloya Makwakwa Village case study
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

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6.5 Contradictions in Chilije Village case study

In this section, I present contradictions identified from three activity systems, which are the TSF & ICS user activity system, implementer activity system and stove production activity system.

6.5.1 Contradictions within the TSF & ICS user activity system

6.5.1.1 Satisfying the requirements for firewood saving and heat retention versus delaying cooking/ (no speed in cooking)

This contradiction is similar in nature to contradiction in Section 6.3.1.1 in the Chapita Village case study because the type of cook stove promoted in both case studies is the same. In this regard, I will not repeat the whole discussion. I will only provide the evidence of the presence of contradictions from the case study.

> ***TSF & ICS user GW:*** *On my side, this* (ICS) *delays me when I cook nsima. Yes, it takes long to cook nsima on the stove. [...]It is different; when we put a pot in the kitchen* (TSF) *the pot does not take long to heat, but for this one* (ICS) *eeh! It takes long. When I cook here* (ICS), *I can use only few pieces of firewood [...]. So when I have less firewood I use the stove so that it works for me.* (Interview # DZ1)

In the above quotation, the participant explained that the ICS delays cooking compared to the TSF. However, she uses the ICS when she has less firewood, despite that it delays the cooking (the last sentence of the quote was also captured in Chapita Village Case study). In this regard, convenience is the most important thing to her. The participant appreciated the stove in terms of firewood saving, but speed outweighs the firewood saving feature. Since firewood is available in this area, most women used the stoves once and abandoned them because the stove does not provide the speed they are looking for, and prefer to go and collect firewood. In this case, it appeared that speed is more important, than the hours spent collecting firewood as substantiated below:

> ***TSF & ICS user YT:*** *When we bought it* (the stove)*, we used it for a short period, and then we stopped and continued to use the TSF. What made us stop was that we saw that it is not fast. If we compare it with the TSF, the cook stove retains heat; also, the cook stove takes less firewood compared to the TSF. The TSF uses more firewood because we put firewood in many places. However, when the stove heats up you can cook several things.* (Interview # DZ4)

In the above quote, the woman clearly explained that she stopped using the ICS because of it was slow compared to the TSF. She also acknowledged s that the stove consumes less firewood and keeps the heat for a long time, and with that heat, you can cook several dishes. In this case, what mattered for the woman was speed of cooking. This contradiction is therefore primary within the tool, the stove as mediating artifact. It is aggravating into a secondary contradiction as below:

6.5.1.2 The stove delays cooking versus convenient low energy cooking

A secondary contradiction occurs between the tool and object of the activity. The tool constrains the subject to work on their object to realize their outcomes because it delays cooking. This manifests through abandoning the stove after first use, and using the stove sparingly (see Chapter 5). Abandoning the stove was mainly captured through observations where the stove was not showing any signs of use such as presence of dark shades from smoke and fire. In most cases, the stove was away from the cooking place, such as in the house, or granary, it was lying somewhere while the TSF was used in cooking (see Chapter 5). It was also augmented with some participant's accounts as reflected in the following speech turns:

> **Researcher:** *How many times do you cook on the stove in a week, let's say every day, or three times or five times a week?*

> **TSF & ICS user YT:** *No, I should not lie, I do not use it* (the stove). (Interview # DZ4)

> **Researcher:** *You do not use?*

> **TSF & ICS user YT:** *No. When we bought it* (the stove)*, we used it for a short period, and then we stopped and continued to use the TSF.* (See also under section 6.5.1.1 for the explanation on why she stopped using the stove). (Interview # DZ4)

Another speech turn, confirms that the person uses the stove sparingly:

> **Researcher:** *During this week- what is the day today?*

> **TSF & ICS user GW:** *Thursday.* (Interview # DZ1)

> **Researcher***: Have you used the stove today?*

> **TSF & ICS user GW:** *I have not lit fire in that* (the stove). (Interview # DZ1)

> **Researcher:** *This whole week?*

> **TSF & ICS user GW:** *No.* (Interview # DZ1)

6.5.1.3 Summary of contradictions

Firewood saving, heat
retention *versus* delaying
cooking (no speed in
cooking)

Stove delays cooking *versus* convenient low
energy cooking

Tools

Object

Subject

Outcome

Rules

Division of labour

Community

TSF & ICS user activity system
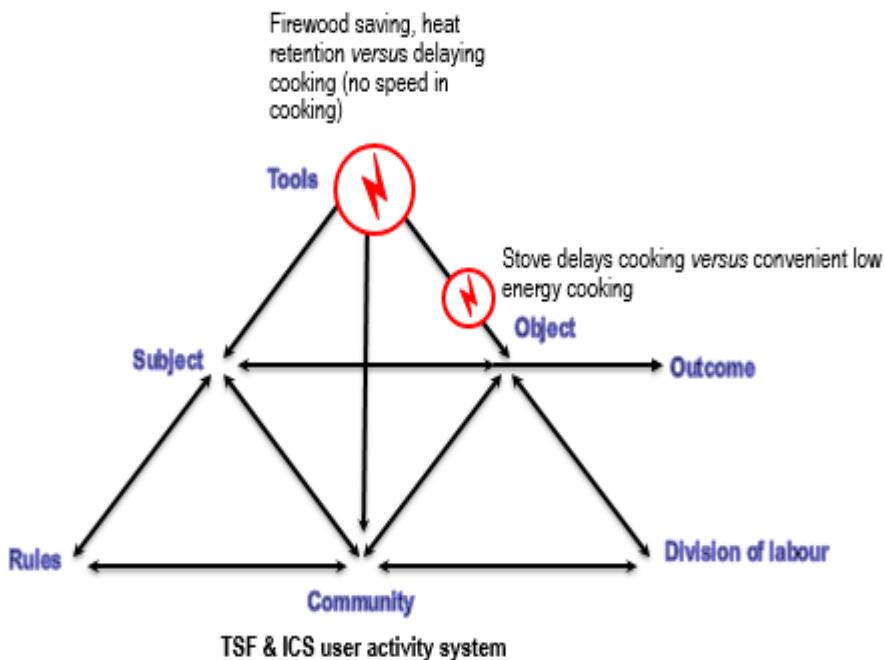
Figure 6.11: Contradictions within the TSF & ICS user activity system
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.5.2 Contradictions within the implementer activity system and between the activity system and the TSF & ICS user, the TSF user and stove production activity systems

6.5.2.1 The need for quality stoves versus failure to provide proper training for the trainers of production groups and supervision of the production groups

The implementer activity system emphasises production of quality stoves (see also Sections 6.3.2.1).

However, the implementers do not foster strategies available to achieve quality:

> **Field Facilitator JK:** *Those people* [the producers] *needed to be supervised properly. But, now these guys the field staff there, they don't have much expertise in the stove. Of course, yes we exposed them to the stove, one time we took them to Balaka. … but still I don't think they got it properly because we just wanted them to appreciate what it* [is]. *I can look at a clay and tell you that this is good clay, this is not good. But to them they can even advise people go ahead* [with unsuitable clay] *because they don't have real expertise in the* [stove production]. (Interview # DZ6)

In the quotation above *Field Facilitator MB* is aware that first, the producers needed supervision to produce quality stoves; second, field staff who work with the production group do not have enough proper training about the stove and that they do not have expertise in determining good clay soil for stove production.

Lack of proper training and supervision is also illustrated in the following excerpt:

Stove producer 3: *We were pounding the clay soil in a mortar. Everyone was pounding the soil in a mortar. The clay soil we have here is problematic. When they trained us, they said we should use feet, but the soil we found did not allow use of feet. But we were using mortars.* (GP Interview # DZ5)

The excerpt from *Stove producer 3* above clearly shows that the group had no supervision and lacked proper training. In fact, before a group starts making stoves, clay soil has to be tested by trainers (see Photo 6.2, first stage); however, the soil the group was using was problematic (see Chapter 5). Feet are used to detect any foreign objects such as stones (Stove camp, 2013). However, by using a mortar the group displayed lack of proper training which the Field Facilitator also pointed out.

Despite the fact that the Field Facilitator was aware of the gaps, coupled with failure to provide proper training to field staff, the implementers needed the production group to produce quality stoves:

Field Facilitator JK: *Some of the stoves when you look at you find that they are not good quality stoves. I can tell you that if you found stoves at Chilije that Tsumbi area, if you find stoves there, some of them are stoves that have been there for over a year or even two years. I actually left them there, rejected them there.* (Interview # DZ6)

The Field Facilitator rejected the stoves for marketing because they were not good quality and would be rejected by buyers and end-users. This knowledge gap necessitates proper training and supervising the production group, which is the mandate of the implementers. However, the training and supervision, which was provided, is superficial, as indicated by the preceding quote. In addition, a rule was put forward for ensuring quality, which restricted the producers from selling the stoves and therefore they were not trained in marketing of the stoves. The excerpt below echoes how the implementers value quality stoves:

Field Facilitator JK: *… because we wanted the producers should concentrate on producing in order not to compromise on the quality they shouldn't be doing the marketing they should concentrate on producing.* (Interview #DZ6)

The contradiction is manifested as inconsistency as well as disturbance (Engeström & Sannino, 2011). The value attached to quality is not reflected in practical activity; at the same time the Field Facilitator is deviating from the scripted ways of doing things in the process of ensuring quality of the stoves. This is a secondary contradiction between the rule and subject; the tools for ensuring quality are available but the subject of the activity does not utilise them.

6.5.2.2 The rule of destroying low quality stoves before firing them versus the failure of the Field Facilitator to facilitate production of quality stoves

One of the roles of the Field Facilitators is to facilitate production of good quality stoves through physical inspection of the stoves in order to maintain stove efficiency standards (see Chapter 5). For example, if pot rests are not aligned properly, the Field Facilitator is supposed to destroy them before they are fired,

so that the clay can be reused. However, the field facilitator was rejecting the stoves after they had been fired:

> **Field Facilitator JK:** *… some of them are stoves that have been there for over a year or even two years. I actually left them there, rejected them there.* (Interview # DZ6)

Of course, one rule of the activity stipulates that they select only quality stoves for marketing. However, the stoves rejected appeared to have come from different production cycles. If all the cycles failed to produce quality stoves, it could be because of lack of proper supervision for the production group as indicated by Field Facilitator below:

> **Field Facilitator JK:** *Those people* [the producers] *needed to be supervised properly.* (Interview # DZ6) (see also Section 6.5.2.1, first quote)

His actions are at variance with the rules because apart from the need to reuse the clay soil, a lot of firewood is used for firing stoves, which would not be sustainable especially if the stoves are rejected. The action of the Field Facilitator is an example of a disturbance that reveals the secondary contradiction within the activity system between the subject and the rules and it is related to contradiction 6.5.2.1 above.

6.5.2.3 The need for many stoves versus the lack of reliable and sustainable market networks and transportation to market

The production group was encouraged to produce many stoves by the implementers in line with the government agenda of rolling out two million cook stoves by the year 2020. However, there is a marketing problem.

> **Stove producer 3:** *But the group is encouraged to continue* [producing stoves]. (GP Interview # DZ5)

> **Stove producer 7:** *They* [implementers] *just encourage us to produce stoves but they do not come* [to collect the stoves for marketing]. (GP Interview # DZ5)

The study area has reached saturation point, since most households have stoves. This requires finding a market elsewhere. Nevertheless, there are no reliable and sustainable market networks and transportation to the market. This is due to the location of the place, which is far from the main trading centres; moreover, the stove is heavy to carry to the main trading centre, a potential selling point.

> **Stove producer 2:** *That is why we stopped producing, like the way you see this place, are there markets? Are we going to be carrying the stoves on the head to the market? Are we going to be carrying them on the head from here? Are we going to be carrying them on the head to Kapala?* (Interview # DZ5)

The quote above reveals transportation problems. The implementers appreciate that transportation is a problem in the study area because of its remoteness. They assisted twice with transportation, however provision of transportation is not within their mandate as implementers of the project.

> *Field Facilitator JK: Even transportation of the stoves sometimes could be a problem. … In Dzalanyama we still had a challenge because there was no provision for transporting the stoves for them, from the producer to them* [Stove promoters] *so that they can take it to the end-user. So they were still selling the stoves, but then still transportation of the stove was a problem. Somebody could only get one or two on a motor cycle. But again even this motor bike it means it was his. … As an implementer myself, I always told them it's not Concern Universal which is going to buy stoves from you. Luckily, yes, we might come in as an organisation to buy from you, but we are not the buyers for the stoves.* (Interview # DZ6)

Unfortunately, the implementers have not empowered the production group with marketing skills since the implementers wanted the production group to concentrate on production so that they do not compromise on quality as discussed earlier (see Section 6.5.2.1 above). This is despite providing the stove production as business to the group.

> *Field Facilitator JK: We gave the production groups this intervention as business to them, but again, to help the problem of deforestation, and the like.* (Interview # DZ6)

One of the outcomes for the intervention is to help women generate income through stove production, nevertheless the project did not support the production group with skills to link to market networks and buyers.

On the contrary, the present challenge is to find stoves as indicated below (see also Section 6.3.2.5). Yet stoves at Chilije were stockpiled for two years because of marketing problems (this is despite some being rejected due to bad quality).

> *Field Facilitator MB: I will find out what is the problem that side, because at present marketing is not a problem. … In general, not that side … with the coming of DISCOVER project, the problem now is to find the stoves. … there was a similar problem with one group in Ntcheu, but now they have sold stoves worth almost three million* [Malawi] *kwacha within this period, so maybe that side it maybe because of distance and transportation.* (Interview # DZ7)

The quote above indicates problems related to overlooking process elements. Due to the remoteness of the area, they are facing marketing problems, which indicates that the project implementers may not have considered marketing and transportation components before project initiation, including the development of linkages between producers, suppliers and end-users.

From the discussion, the contradiction manifests as a double bind; it is between the tools and the outcome. There is need to give production groups a business through stove production; yet it seems impossible to achieve this. There is need to ensure quality, yet it seems impossible to achieve quality.

6.5.2.4 Absence of tools to train producers in marketing skills versus the need for income generation from stove production

The above contradiction (6.5.2.3) influences a quaternary contradiction between the tool of the implementer and the outcome of the stove production activity system. This contradiction is reflected in the quote below:

> **Field Facilitator JK:** *We gave the production groups this intervention as business to them …* (Interview # DZ6)

> **Field Facilitator JK:** *… because we wanted producers should concentrate on producing in order not to compromise on the quality they shouldn't be doing the marketing they should concentrate on producing.* (Interview # DZ6)

In the quotes above, the Field Facilitator noted that production groups were not trained in marketing because doing that could compromise production of quality stoves. The rule of the activity stipulates that producers should not sell cook stoves in order to facilitate production of quality stoves. This rule influences the absence of tools for training the producers in marketing skills. This situation creates a clash between the outcome of the stove production activity system and the tools of the implementer activity system.

6.5.2.5 Using top-down approaches to facilitate adoption and use of the stove versus failure of the top-down approach to influence use of the cook stove

The implementers in the case study used Village Headmen (chiefs) to insist that everyone should have a stove so that when the benefits come from carbon trading, nobody enjoys the benefit of a development that they never took part in.

> **Field Facilitator JK:** *… there was that initiative to make sure that adoption should be at village level, we should have 100% adoption, because say the* [carbon] *credits are in, it will not be to individual users but it will be for the community. … so that's how we went through Village Heads and so on, can you tell your subjects there is this other advantage of using the stove, you are saving carbon by using the stove so we have these other benefits.* (Interview #DZ6)

A community would benefit from carbon trading when many people use the stove because they reduce the amount of carbon they are releasing in the atmosphere. However, it is usually assumed that when people purchase the stoves they utilise them. In this study area, evidence shows that the Village Headmen issued orders (to buy a stove) that would attract a punishment if not obeyed:

> **Field Facilitator JK:** *… Sometimes the Village Head had to say if you don't do ABC, then you will face this punishment.* (Interview # DZ6)

About 99 percent of the households in the study area had a stove. This could have something to do with fear for punishment within the community members. The Village Headman's command, with influence from the project implementers, had influenced people to purchase the stove. However, it never influenced

them to use the stove. When I asked the Field Facilitator why someone would purchase a stove and not use it, he responded:

> **Field Facilitator JK:** *Because the Village Head has said, everybody has to have the stove. … Coming as a command from the village leader so you have to do as above.* (Interview # DZ6)

In the quote above, the Field Facilitator appears to be aware that people may not be using the stove because they purchased it out of fear from the Chief's punishment. The following example indicates that some people abandoned the stove. This indicates that the Chief's command did not influence utilisation of the stove:

> **TSF & ICS user YT:** *I should not lie, I do not use* [the stove] *… when we bought it* [the stove]*, we used it for a short period, and then we stopped and continued to use the TSF.* (Interview # DZ4)

The citation above indicates that the top-down approach did not influence community members to use the stove. See Sections 6.5.1.1 and 6.5.1.2 for more evidence that the chief's command did not influence use. This means that influencing use of a cooking technology requires much more than top-down approaches; rather, understanding the contradictions that the technology presents can help in finding new ways of working. The contradiction is manifesting as an inconsistency, the same approach that influences purchasing the stove cannot influence use. The contradiction is within tools used for disseminating the stoves. It is therefore a primary contradiction.

6.5.2.6 Between the need to address environmental concerns through the improved cooking technology and putting the end-user training on the periphery of project activities

This contradiction is similar to two contradictions in the first case study (see Sections 6.3.3.1 and 6.3.4.1). This is partly because the same institution implemented the stove project in the Chapita and Chilije case studies, despite involving different personnel on the ground. Therefore, this indicates a systemic contradiction within the activity system, in the way they reach out to the end-users of the technology. In this regard, I will not repeat the whole discussion. However, I will provide evidence of the manifestations of the contradiction through the quotes below. The most important difference is the way the contradiction manifests. In this case study, end-users expressed feelings of being isolated from the stove activities; they expressed feelings of exclusion (not belonging). Yet the outcomes of the implementer activity system depend upon end-users cooking on the stove. When I asked how they knew about the stove, and whether there has been a sensitisation meeting in the community on the stove, three participants gave the following responses:

> **TSF &ICS user GW:** *We knew about it* [the stove] *when the production group started making stoves, we just go and buy from them. … There has never been a meeting. We only saw our friends **who were employed** in the production of cook stoves; they went there to learn together with the visitors who came* [to teach]. (Interview # DZ1)

> *TSF &ICS user YT: When they started producing the stoves, **the owners** who were producing the stoves, started using the stoves as **owners** and they started explaining to us; buy the stoves because stoves are good. … They [implementers] only came once; they only met **the owners** who produce stoves. … not **outsiders**. … We just hear [about the stove] from the producers, not from the implementers holding a meeting, no, just from **the owners** who produce the stoves. (Interview # DZ4)*

> *TSF user NG: As I said at the beginning that **I am an outsider**, so when they hold stove meetings only those who are in the group are told. … Those in the group [are informed]. When they have meetings, they tell each other. To come to pick some of us who **are on the side**, to go and know their secrets, when we do not even know what they talk about, it will be like joining the 'big dance'[33] performed by a cult when you do not even know how to dance. So, they just **sideline** us. … However, I have never heard about any stove sensitisation meetings, they would lie to you if they tell that. We would have seen the gathering; we would have known and find out what was going on and we would know that they are talking about stoves. (Interview # DZ3)*

The quotations above show that the implementers put end-users on the periphery of the cook stove project activities; they did not sensitise them on the technology or demonstrate to them how they could use it. The end-users learn about the stove from the production group as a way of advertising their business.

The quotations also highlight how the end-users feel alienated from the stove project activities. The phrases in bold indicate how they feel – that they are 'outsiders'. They refer to the production group as 'owners' of the project. In the first quote, participant *TSF and ICS user GW* thought that they were employed, which was not the case. In the third citation, *TSF user NG* uses a metaphor of 'the big dance' (see footnote explanation) to capture how they feel alienated from the project activities. The contradiction manifests as a critical conflict. It is a secondary contradiction between the tools and the object of the activity.

6.5.2.7 Tools used for project implementation versus alienating end-users

The secondary contradiction influences a quaternary contradiction between the tool of the implementer activity system and the subject of the TSF and ICS user and TSF user activity systems, as they do not feel the ownership of the cook stove technology. This may constrain the TSF and ICS user to work on their object (see Section 6.5.2.6, excerpts from *TSF user NG* and *TSF & ICS user YT).*

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[33] A big dance is a traditional religion dance, it is a cult with its secretive operations; you have to be initiated to be a member of the cult. When they perform the dances, you are not allowed to join; only the members of the cult who share a code can join. Members wear masks when they dance and identify each other through the code. It is a common dance among the Chewa ethnic group.

6.5.2.8 Summary of contradictions

The figure below summarises contradictions in this section.
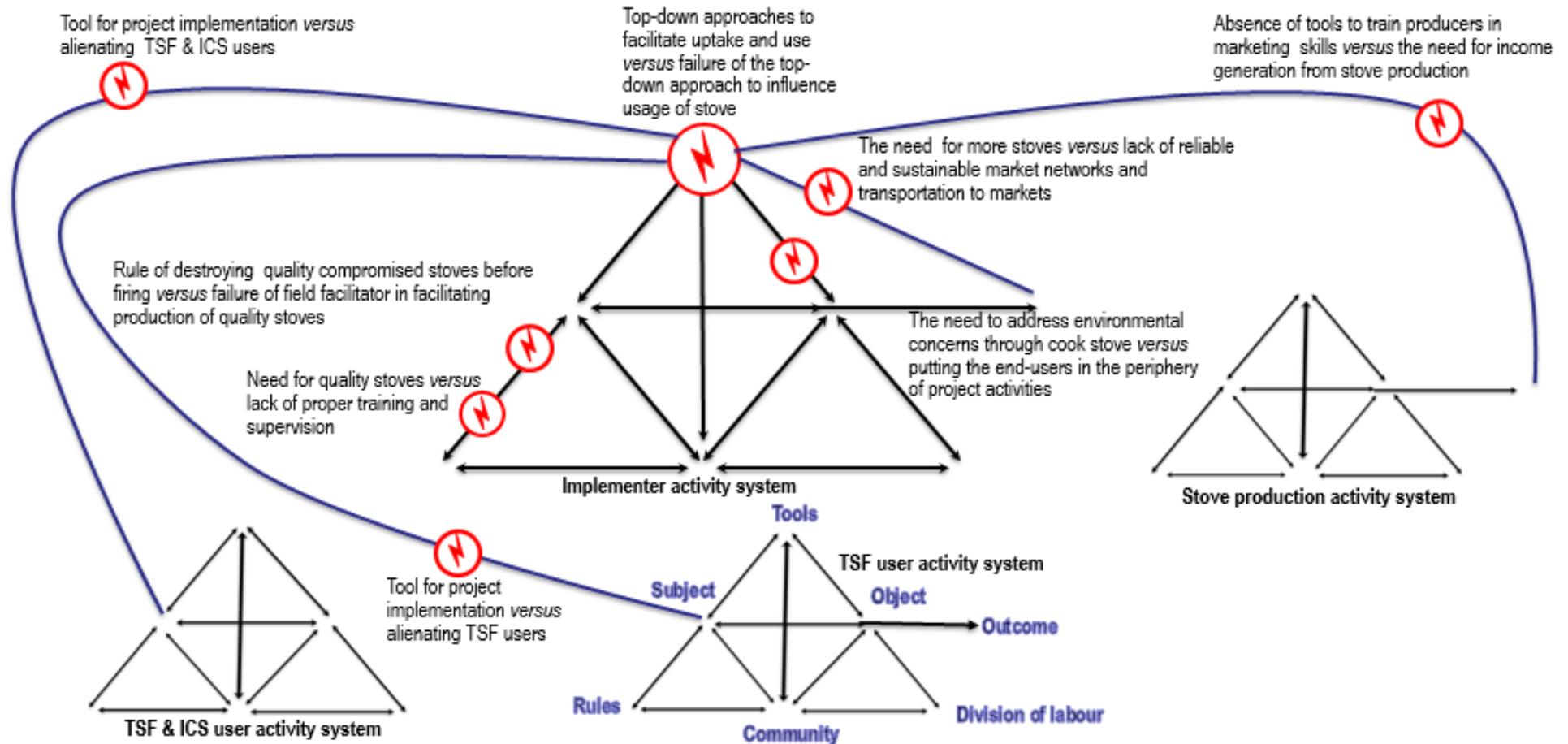
Figure 6.12: Contradictions within the implementer activity system and between the activity system and the TSF & ICS user, the TSF and stove production activity systems
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.5.3 Contradictions within the stove production group activity system and between the activity system and the implementer activity system

6.5.3.1 Serving individual interests versus serving group interests

Within the production group activity system, members elected an executive committee including chairperson, secretary, and treasurer. The chairperson is a woman and the treasurer is a man. The Field Facilitator responsible for disseminating stoves in the study area is a man, and was more in touch with the treasurer, to the extent that the chairperson was not aware of what was taking place in the development of the stove project within the group. For example, she was not sure whether the group had received the money from stove sales that Concern Universal assisted with transportation and selling on behalf of the group or not. Further, the money that came out of the sales from two production cycles had not been distributed to the members and two years had passed since the sales were made. In fact, the group had never received any money from stove sales since they had started stove production. It appears that the treasurer, as reflected in the following exchanges, had embezzled the money:

> *Stove producer 3 (chairlady): So what happened was that when they* [Concern Universal] *came to collect the stoves the very first time, they said they would bring the money, later we were told that the money came, but they said there was a balance to be brought. So we waited, but they say the money* [the balance] *came but I did not see it, yet I was the chairperson of the group, but the money came. That is why the group is in despair because they have never received* [the money] *… Up to now we have not shared the money, it is still with the treasurer. … Even the ones we sold at the end* [the second cycle] *we are yet to share the money; we are still waiting. … The money for both cycles came.* (GP Interview # DZ5)

> *Stove producer 1: The say the money came.* (GP Interview # DZ5)

> *Stove producer 3 (chairlady): They say…* (GP Interview # DZ5)

> *Stove producer 1: Since we just hear from others that the money came.* (GP Interview # DZ5)

> *Researcher: Where do you hear from?*

> *Stove producer 2: From the people, the one who receives the money.* (GP Interview # DZ5)

> *Researcher: Who receives the money?*

> *Stove producer 1: The one who receives the money says the money came.* (GP Interview # DZ5)

> *Stove producer 3 (chairlady): Our leader.* (GP Interview # DZ5)

> *Stove producer 4: The leader has misappropriated the money.* (GP Interview # DZ5)

> *Stove producer 1: Maybe he has not embezzled; maybe he still has the money.* (GP Interview # DZ5)

> *Stove producer 5: Are you sure, he has kept – has he kept?* (GP Interview # DZ5)

> *Stove producer 1: What can we say since it is our treasurer?* (GP Interview # DZ5)

Members also expressed that, despite that the implementing institution stopped visiting the production group, the Field Facilitator was inviting the treasurer to attend meetings in town, but he never shared the outcomes of the meeting with the group:

> **Stove producer 3 (chairlady):** They [implementers] *stopped coming; they do not come.* (GP Interview # DZ5)

> **Stove producer 2:** *He only meets the person we told you about* [the treasurer]. (GP Interview # DZ5)

> **Stove producer 1:** *The one who goes for training.* (GP Interview # DZ5)

> **Stove producer 1:** *The work is for the group but only one person goes for training.* (GP Interview # DZ5)

> **Stove producer 2:** *When time comes for training we just notice he is not around, he does not do it for the group … The Field Facilitator entices this person* [the treasurer] *to go for training.* (GP Interview # DZ5)

> **Stove producer 7:** *They do not do it for the production group; it is out of their friendship, so that they advance their homes.* (GP Interview # DZ5)

From the quotes above, it appears that the Field Facilitator and the treasurer of the stove production group abused their leadership roles for their individual benefits. The contradiction is expressed as a 'collective' conflict. It is a primary contradiction; there is a clash within the leadership between satisfying individual interests and group interests. Therefore, it is within the division of labour. The primary contradiction influences a secondary contradiction discussed below.

6.5.3.2 Leadership roles versus the outcome of the activity system

The stove production group had not realised the outcome of their activity since they engaged in the activity. This manifested as a disturbance through the actions of both the treasurer and the Field Facilitator who were deviating from the normal scripted (Engeström & Sannino, 2011) ways of performance for a collective activity, where openness and transparency are crucial. The Field Facilitator invites only the treasurer for training without informing the chairperson and the secretary on several occasions as expressed by *Stove producer 2* in Section 6.5.3.1 above and the entire group. The treasurer did not take any feedback to the group. He did not explain to the group about the sales or the money, or distribute the money to the members (see *Stove producer 3,* first quote in Section 6.5.3.1 above). The contradiction is therefore secondary, between division of labour and the outcome.

6.5.3.3 Between following a cumbersome production process to produce quality stoves and the production of cracked stoves on the upper door that reduces quality of the stoves

This contradiction is similar to the one discussed in Chapita Village case study (see Section 6.3.2.1). However, it was less intense than in the first case study. Nevertheless, it creates tension between the

TSF & ICS user activity system and the production group activity system. The explanations as to why there were stove cracks were similar to those given in Section 6.3.2.1. The following provides evidence of the manifestations of the contradiction in this activity system:

> **Stove producer 3:** *When they buy the stove and when it cracks, they say "your stoves are not durable; they just consume our money, go and get your things* [stoves]". *So how do we go and get them?* (Interview # DZ5)

> **Stove producer 5:** *When it cracks, they say bring back my money*. (Interview # DZ5)

> **Stove producer 1:** *Yet when they taught us, they said it is a breathing space … and that we should tie it* [the stove] *with a wire, but around here, we do not understand each other.* (Interview # DZ5)

The contradiction stems from the approach used in the dissemination of the stoves, since they target the production group, users do not know what to expect when they start using the stove and what to do about it. The contradiction manifests as a double bind. It is a secondary contradiction between the rule and the object. A quaternary contradiction occurs between the rule of implementer activity system and the object of the stove production activity system. This contradiction is similar to contradiction in Chapita case study, therefore, I have not discussed it here to avoid repetition.

6.5.3.4 Summary of contradictions

The figure below summarises contradictions in this section.
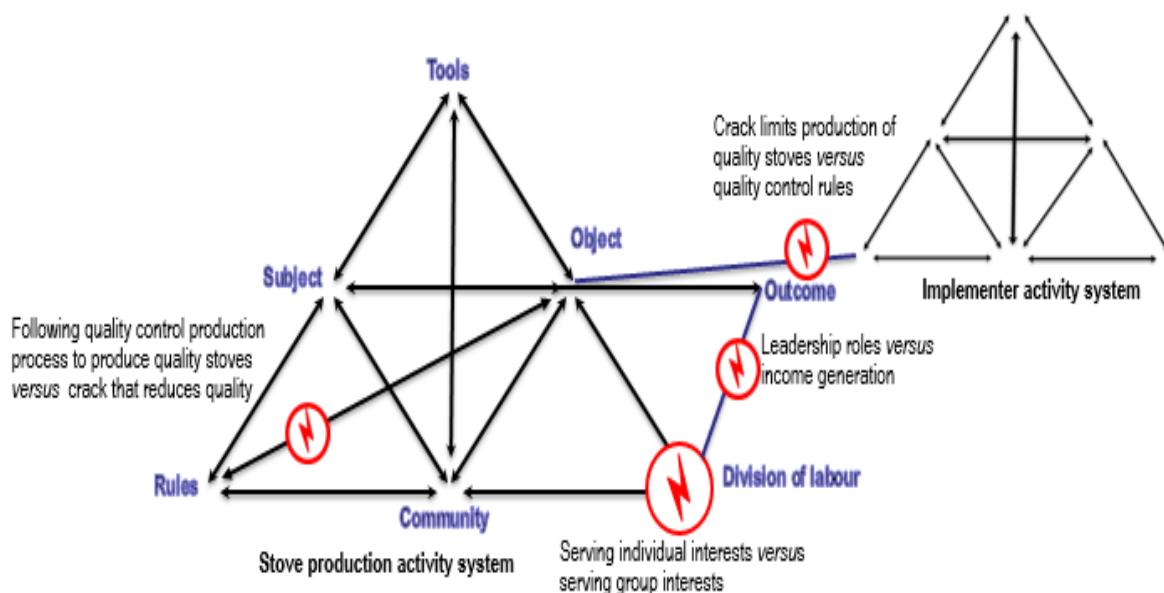
Figure 6.13: Contradictions within the stove production activity system and between the activity system and the implementer activity system
Source: Adapted from Engeström 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.5.4 Summary of contradictions in Chilije Village case study

The contradictions identified in Chilije Village case study are summarised in Figure 6.14 below. I provide the summary in a table (see Appendix 24) to show clearly the three types of contradictions identified.
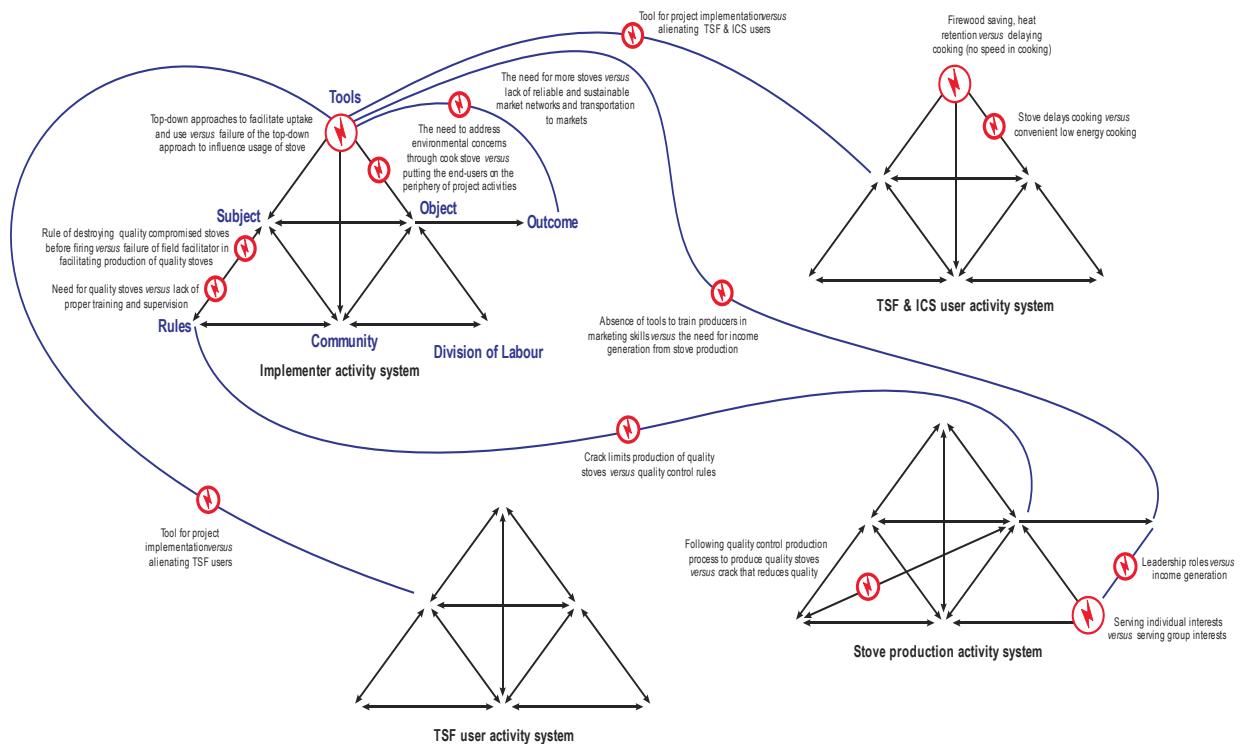
Figure 6.14: Summary of contradictions in Chilije Village case study
Source: Adapted from Engeström, 1987; Centre for Activity Theory and Developmental Work Research, 2003

6.6 Cross-case overview of the main types of contradictions

This section provides a cross-case overview of the main types of contradictions in each case study. In Chapita Village case study the contradictions among end-user activity systems revolved around saving firewood, delays in cooking and struggles in cooking *nsima* emanating from the designs of the ICS, the Chitetezo Mbaula, which were pulling in opposite directions with the Implementers' aim of addressing health-environmental problems. At the level of production and across the other activity systems, the main contradictions revolved around compliance with quality control procedures to ensure quality stoves and cracked stoves that reduced quality of the stoves; demand and unavailability of the stoves; investment in complex production tools and cumbersome labour and the abandonment of the production, the exchange value of producing stoves and the use value of serving families living in poverty with the stoves. Some contradictions concerned specifically the implementation of the ICS. The main types included the use of incentives that promoted and constrained uptake of the ICS and the need to address health-environmental concerns and the positioning of end-users on the periphery of ICS programmes.

It is worth noting that the end-users activity systems in Chilije Village and Chapita Village case studies shared the main types of contradictions. This also applies to the contradictions at the level of production and policy activity systems. However, in Chilije there were contradictions around leadership dynamics at the production level.

In Waziloya Makwakwa case study, the main types of contradictions in the end-user activity systems revolved around the need for and the scarcity of stove construction materials; saving firewood and retention and generation of too much heat from the ICS; and the requirement for a kitchen for ICS construction on one hand and division of labour in the construction of kitchens, as well as the need to address health concerns and environmental concerns with the ICS technology, on the other hand. Some of these contradictions were across the end-user and the implementer activity systems. At the level of production, they revolved around the exchange value of stove construction and the use value of serving families living in poverty with the ICS technology. The main contradictions concerning implementation included the scarcity of stove construction materials and project implementation approach employed.

6.7 Causal mechanisms influencing contradictions across case studies

This section discusses possible causal mechanisms influencing contradictions identified. Using retroductive analysis, through the lens of Critical Realism I sought to explicate possible causal mechanisms that may be influencing the contradictions around uptake, utilisation and learning of the ICS practice in the three case studies. The discussion in Chapters 1 and 2 provides a history of the evolution of the ICS practice within the socio-cultural and economic context of Malawi in general, and specifically for the three case studies. The socio-cultural and socio-economic situations against the backdrop of environmental concerns especially deforestation, which has resulted in firewood scarcity and the need to save the remaining forest (particularly in Chilije village case study) provides an explanatory principle.

To begin with, poverty seem to give rise to most contradictions identified in the three case studies. Specifically, GoM of Malawi over-relies on donor support (Dionne et al. 2013) for its economic support, due to its socio-economic status. This situation penetrates most developmental projects, including the Improved Cook Stove practice. Most NGOs in Malawi are dependent on funds and some technical support from international donor agencies (Kalinga, 2012). This includes NGOs implementing ICS projects in the three case studies (see Chapter 1, Section 1.4.1), as well as the National Cook Stove programme (see Chapter 5, Figure 5.23). The situation culminates in prescribing how projects are carried out, including duration and outcomes that satisfy the objectives of the funders (see Section 6.3.4.3). First, this seems to encourage top-down approaches adopted by ICS implementing NGOs which are used to

satisfy the donors, without taking into consideration the requirements for the facilitation of learning of the technology amongst end-users. For example, in Chapita Village case study, end-users were prompted to purchase stoves in advance before they saw the stoves or before receiving proper sensitisation on performance and handling of the stove. The top-down approach adopted gives rise to yet another constraint or absence in the diffusion and adoption of socio-technical innovations. Due to the pressure mounted on implementing NGOs to satisfy donor requirements, some process elements were overlooked, for example, comprehensive research and development on the technology under development that includes adequate socio-cultural understandings of contextual and cultural cooking practices. One notable example is the crack that develops on the upper door of the Chitetezo Mbaula ICS (see Section 6.3.2.1) disseminated in the Chapita and Chilije case studies, which is also a common stove nationally. Another example is the lack of end-user training and training manual. A further example is the lack of transportation and distribution networks for stove marketing which has left stoves piling up in the Chilije case study. Secondly, the scenario has implications on the effectiveness of the policies and/ or in availability of policies governing ICS projects implementation since some NGOs have "no ties with Government" (Kalinga, 2012, p. 366). The Deputy Director DoEA remarked on the negative implications of donor-driven projects on adoption and quality of stoves produced, and how the "terms and conditions prescribed by the donors" takes away the decision-making roles of Government in creating effective policies on dissemination and implementation of ICS projects in communities (see Section 6.3.4.3). The absence of comprehensive and effective policies seem to give rise to a number of contradictions in the uptake and utilisation of ICS. As Sovacool, as cited in Geels et al. (2015, p. 31) asserted,

> As the barriers facing ... energy efficiency are diffuse, a multitude of policies must be comprehensively implemented to eliminate them. … and until comprehensive policy changes are implemented, renewable energy and energy efficiency will never realise their full potential.

Another causal mechanism that gives rise to the contradictions is power relations existing among the various actors at various levels. Power relations relates to the causal mechanism discussed above, as it appears to stem from the over dependence of donor support. This occurs at different levels. At the high levels, it starts with the donors prescribing terms and conditions on the outcomes of ICS projects. The donors exert their power consciously or subconsciously on Government (DoEA and NCSSC in this particular case) and NGO practitioners, which in turn leads to adoption of approaches that primarily satisfy the donors' requirements as pointed out earlier. The effect of the approaches is reflected in the ways projects are implemented on the ground as discussed earlier. This constitutes another level of power relations between implementing NGOs and targeted communities. For instance, Concern Universal concentrates on production of stoves by setting up and training production groups in response to meeting the targeted production of two million cook stoves by 2020 (Chapter 5, Section 5.2.1.1). Yet the end-user

is left on the periphery (see Sections 6.3.3.1 and 6.5.2.6). Concern Universal prescribes how stoves are sold (by Stove promoters and not the producers) in order to meet agendas such as tracking carbon credit sales. Further, it controls who sensitises end-users about the ICS by controlling who receives this knowledge (see Section 6.3.3.1). The price of the stove remains the decision of the implementing institution and not the women producing the stoves, despite concerns expressed on low prices (see Section 6.3.2.5). The price is controlled to facilitate affordability, yet it is done at the expense of scarcity of stoves (see Sections 6.3.2.5 and 6.3.2.9). The end-users are at the receiving end of all the existing power dynamics and perceive themselves as "outsiders" and the other actors as "owners" of the ICS project, for instance (see Section 6.5.2.6). This problematic situation takes away ownership of the ICS project. Lack of ownership may have negative implications on how communities take up renewable energy innovation projects (Warren & McFadyen, 2010). Further, the power relations are reflected in the unidirectionality of the learning interactions existing in the three case studies (see Figures, 5.19, 5.20 and 5.21).

Successful-project-syndrome is another possible causal mechanism that gives rise to some contradictions in the three case studies. I have defined the concept in this study as copying a project from another area because it was successful without engaging in contextual analysis of the target project area before project implementation. There seems to be a deep-seated and widespread tendency for project implementers to transfer a successful project from another context, local, national, international or academia and/ or scientific laboratories contexts without adapting it to a new context. The failure to adapt the ICS projects to their new contexts influences some contradictions in the three case studies. Contextual factors include, among others, cultural factors, geographical factors and environmental factors. Cultural factors relate to historically shaped traditions and beliefs (Brohmanna, Feenstrab, Heiskanenc, Hodsond, Mourikb, Prasade & Raven, 2007, p.7). For example, Chitetezo Mbaula was not adapted to the traditional cooking practices in Malawi. The fixed stove in Waziloya case study overlooked traditional space heating practices and the tradition practice that explains lack of and resistance in kitchen construction in the case study area (see Section 6.4.1.1). In terms of geographical factors, one best example is the case of scarcity of *ndhulani* and cow dung in Waziloya Makwakwa case study. Further, in Chilije case study environmental, as well geographical factors, seem to explain some contradictions. Some marketing problems experienced are in part due to the remoteness of the area. Further, evidence shows that upon having a successful ICS project in some part of Ntcheu district with sensitisation messages that focused on the characteristic of saving firewood of the stove, the project met some resistance in Chilije case study because of abundance of firewood due to its close location to Dzalanyama forest reserve. Despite that, the one major aim of the project was to save the remaining forest; the

resistance prompted Concern Universal to focus sensitisation messages on other benefits of the stove later. This example serves to elaborate that the project was not adapted to the environmental context. According to Brohmanna et al. (2007), "the analysis of controversial and successful projects (specifically renewable and energy efficient) projects shows that new technologies cannot be merely 'dropped' into a new context without preparation and adaptation" (p.10). Brohmanna et al. continued to elaborate that:

> The problem of technology transfer … relates to the social and cultural embeddedness of technologies. Learning through local experiments is crucial for technological development, but the transfer of these local experiences from one site to another is not unproblematic. Renewable and other new energy technologies are prime examples of both the importance of local experiments, and the problems of transferring them to other sites. (p.1)

On the other hand, Geels, Schwanen and Sorrell (2015) contended that diffusion of innovation requires the process of 'disembedding, travel and reembedding' (see Section 6.4.1.1, single quote in original text). The foregoing discussion shows that successful-project-syndrome is a possible causal mechanism influencing some contradictions in the three case studies.

6.8 Conclusion

This chapter has discussed contradictions identified in the learning, uptake and utilisation of the ICS in three case studies. In order to access contradictions, eight discursive manifestations of contradictions have been used and discussed. Four types of contradictions were identified and discussed. The contradictions occurred within elements of activity systems, between the elements, and some between the old and new versions of the same activity system, while some occurred between interacting activity systems. It is also worth noting that there were similarities in the contradictions identified especially for Chapita and Chilije case studies; however there were also some differences, which may be due to differences in contextual factors. The similarities could be due to that the same organisation was responsible for implementing the cook stove project in the two case studies. They also implemented the same type of cook stove. The contradictions identified within the ICS and TSF activity system within the tool of the activity, the ICS, may indicate that other communities using the Chitetezo Mbaula may be facing similar contradictions in their interaction with the ICS. Contradictions identified in Waziloya Makwakwa are context-specific. This may be because the type of stove as well as the organisation responsible for implementing the project are different from the two case studies. However, similar causal mechanisms influence the contradictions across case studies. Possible causal mechanisms identified include poverty, power relations and successful-project syndrome. The identification of contradictions in the learning, uptake and utilisation of ICS provides a need to carry out BCCLW and expansive learning in order to resolve them. The next chapter (Chapter 7) is therefore dedicated to show how the expansive learning was conducted and how some contradictions were resolved. Chapter 8 reflects on the

Transformative Agency Pathways opened up from the Expansive Learning, and points to generative possibilities as well as difficulties experienced in addressing and confronting some of these contradictions.

CHAPTER 7: EXPANSIVE LEARNING PROCESSES IN TWO CASE STUDIES

7.1 Introduction

This chapter answers question 4: How can learning interactions within activity systems and between *key* activity systems be expanded to facilitate sustained uptake and utilisation of Improved Cook Stoves (ICSs)? Chapter 8 also addresses this question.

This chapter reflects on how the transformative agenda of this study was generatively engaged. It focuses on how I worked with research participants in Chapita Village and Waziloya Makwakwa Village case studies to analyse conflicts and disturbances in their activities and search for ways to transform their current practices (Haapasari et al., 2016). This was aided with BCCLWs, which I organised and facilitated, based on ethnographic data that I had collected from the exploratory phase of the study as discussed in Chapter 3, Section 3.7 and the subsequent analysis of contradictions reported in Chapter 6. It was also influenced by analysis of learning experiences and cultures amongst research participants reported in Chapters 4 and 5, and an understanding of the ICS activity and activity systems reported on in Chapter 5. Interviews were the main sources of mirror material, however, during analysis of problematic situations participants referred to observed phenomena in the practice as contained in observational data. As noted in Chapter 4, observations of actions were an important facet of the data for this study. The chapter builds on Chapter 6, which discussed the contradictions identified in the three case studies. As indicated in Chapter 3, Section 3.5.1, contradictions are the driving force of formative interventions.

As indicated earlier (see Chapter 3), I did not facilitate expansive learning processes in Chilije Village case study due to financial constraints. The expansive learning processes, however, started when I engaged with research participants in the first phase; research participants started voicing the tensions, conflicts and disturbances in their various activities. Some research participants had already started questioning, reflecting on the problematic situations inherent in their current activities and started thinking about ways of resolving the problematic situations (Chisoni, 2016a). For example, in Waziloya Makwakwa, a project officer expressed that:

> *I was reflecting on this, that if we continue experiencing challenges with* ndhulani *… and I asked the field facilitator from Balaka, when we met in Lilongwe, about what could be done, since we have challenges with scarcity of* ndhulani. (Chisoni, 2016a, p. 61) (Interview # MZ8).

In the same way, in Chapita case study, the stove production group reflected on a problematic situation in a group interview as follows:

> *Stove producer 2: They [implementers] say it is the breathing space of the stove …. However, we are desperate to find the kind of knowledge needed to make that stove smooth without any crack. Our thoughts are troubled, that, what expertise can we come up with to produce a smooth stove without the breathing ...? So we do not know that from the higher level experts up to our level here, haven't they found the knowledge [on how to deal with the crack]?* (GP Interview # BK1)

It is worth noting therefore that participants had started searching for solutions for some problematic situations. However, they had not found an approach that would support the development. The idea for initiating expansive learning processes was to support practitioners work out contradictions in their activity (Sannino et al., 2016) and find new ways of working. According to Akkerman and Bakker (2011), the manifestation of boundary crossing learning in a set of data provides potential for implementation of boundary crossing laboratories. Thus, the situation as evidenced from ethnographic data, provided me impetus for the facilitation of expansive learning processes using BCCLW in order to facilitate horizontal learning among practitioners. This allowed participants to move across the boundary of their activity systems, seek, and give help, find information and tools (Engeström & Sannino, 2010) for the development of a new joint activity. After initially separating research participants in their various activity systems, I brought them together in a space where they analysed the history, contradictions, and zone of proximal development (ZPD) of their joint activity system; they designed a new model and implemented some aspects of the new model.

The chapter starts with a discussion of expansive learning processes in the Chapita case study and then the Waziloya Makwakwa case study. The discussion focuses on the epistemic actions in the expansive learning cycle (see Chapter 3, Figure 3.4). It will highlight how I worked with the principle of double stimulation, aroused a conflict of motive (see also Chapter 8), how participants defined the ZPD, and how participants ascended from abstract to concrete through identification of a germ cell (see Chapter 3, Section 3.5.2).

7.2 Expansive Learning Processes in the Chapita Village Case study

I facilitated BCCLW in the Chapita case study nine months after ethnographic data collection. I started with a planning meeting, which was held on 22 January 2016, ten days before the commencement of the BCCLW. This was done to give participants time to prepare for the workshops, and on my side, I needed to analyse the outcomes of the planning meeting as well as make all arrangements for the smooth running of the workshops. I then conducted four-day BCCLWs as outlined in Chapter 3, Section 3.7.5.1, and Appendix 14. The workshops included 19 participants, representing seven activity systems instead of eight as planned because there was no representative from the policy activity system (see Chapter 3, Section 3.7.5.1). Activity systems included implementer, stove production group, promoter, trainer, ICS

user, TSF user, and TSF and ICS user activity systems. In addition, there was a Village Development Committee member from Chapita village and a practitioner from CADECOM Balaka office as an outside expert in ICS dissemination. We also had an additional trainer in session 5 as explained in Chapter 3, Section 3.7.5.1. The Field Facilitator representing the implementer activity system only participated in the planning meeting and he was not available for the subsequent sessions. As indicated in Chapter 3, Section 3.7.5.1, participants expressed their disappointment in the absence of the implementers, hence a meeting was organised to brief him on the progress of the workshops (see Chapter 3, Section 3.7.5.1 and Appendix 14). For follow-up workshops, we had four new participants, including two representatives from stove production activity system; a Forestry extension officer who was assigned to work with the research project community and the SEMU officer from the implementer activity system (see Chapter 3, Section 3.7.6).

7.2.1 Identification of shared object

Identification of a shared object among the activity systems working with the ICS took place during the planning meeting. The purpose of the planning meeting was to continue charting the situation and to provoke participants to recognise the need for change and potentially commit to the development of the activity (Engeström et al., 1996). As indicated above, seven activity systems were represented during the planning meeting. After explaining the purpose of the meeting and giving an overview of BCCLW and instruments, participants (especially from the production group and the implementer activity systems) started questioning the current activity; more specifically, they indirectly blamed each other's roles in the ICS practice. This prompted me to begin a discussion around a shared object although I had planned this activity for the first session of the BCCLW. Participants formulated the shared object as follows: *"Successful dissemination, production, and cooking on Chitetezo Mbaula in order to protect and allow regeneration of woods and protect the environment"*. This was the initial shared object; however, as discussions continued participants elaborated the shared object and included *effectively* and *conveniently* in session 3 (see Appendix 14). The word *"convenience"* was added to describe the convenience that participants required when cooking on the ICS. The outcome of the planning meeting was the project outline that described participants' commitment to carry the intervention, the shared object, scheduling and timing of the workshops, participants who attended and other logistics (see Appendix 7).

7.2.2 Analysis of contradictions

Analysis of contradictions started with presentation of mirror data that I had carefully selected to include all problematic situations (in sessions 1 and 2 of BCCLW) (see Appendix 14), which were evident from the interview data, regardless of the number of occurrences. It proceeded with historical analysis and analysis of activity systems (in sessions 3 and 4) (see Appendix 14). The selection of mirror material in

that way was important because some issues, which appeared insignificant from the interview data, aroused hot debates and emotions during the workshops. For example, the contradiction which related to misappropriation of incentives meant for the promotion of uptake of ICS (see Chapter 6, Sections 6.3.3.3 - 6.3.3.6) appeared negligible from interview data but during BCCLW, it took a dramatic turn as evidenced below. I used mirror material as the first stimulus. Some of the problematic situations triggered a conflict of motive more from participants than others. For example, misappropriation of incentives aroused emotions to the extent that, on one occasion the scribe declined to write a point in order to close discussion on the topic after research participants had agreed:

> *Researcher: Let us close this topic now …. She said whosoever receives the pigeon peas has no transparency because the pigeon peas is sold before the beneficiaries receive. All right, write that point on that side.*

> *Participant SB (scribe): No, I am not going to write that.* (BCCLW BK2)

> *Researcher: Are you refusing?*

> *Participants SB: Because the pigeon peas is delivered to me. I have also said when ten people buy stoves; I receive pigeon peas for ten people.* (BCCLW BK2)

> *Researcher: So why are you not going to write that point?*

> *Participant SB: I will not write unless I understand what they mean when they say whosoever receives the pigeon peas is not transparent. Whom exactly are they talking about?* (BCCLW BK2)

Another example was related to the problems encountered in the cooking of *nsima* (see Chapter 6, Section 6.3.1.4). This happened after a participant had suggested using a piece of wood as a support for the pot, to avoid the pot slipping:

> *Participant RB: … So, I take a piece of wood, I put it against the stove like this … how many days will the stove last before it breaks?* (BCCLW BK2)

> *Participant RK: It would break.* (BCCLW BK2)

> *Researcher: She is asking how many days it will take before the stove breaks.*

> *Participant RB: How many days…?* (BCCLW BK2)

> *Researcher: How many days? … can you respond to the question?*

> *Participants: Yes.* (BCCLW BK2)

> *Participant KG: We should not frighten each other. Why asking about the days? We should not scare one another [noise].* (BCCLW BK2)

> *Participant RB: No it cannot work, maybe if it were made of steel [noise].* (BCCLW BK2)

> *Participant RK: She is not scaring anybody (noise).* (BCCLW BK2).

> *Participant DC: She is not scaring anybody, she is just explaining; she is only following up the question – that since the stove is made of clay and with the piece of wood against it … [noise].* (BCCLW BK2)

These are few of the examples. I allowed the emotions to take charge in and among the participants so that they could engage in deep analysis of the problematic situations. In order to bring back the discussion to an intellectual analysis from the emotional conflicts, I constantly highlighted the elements of the activity system, which were related to the problems under discussion as guided by Haapasaari et al. (2016). This means that I had started using the triangular model as second stimulus to help participants cope with the conflict of motives; the triangular model was used fully in sessions 3 and 4 when participants analysed the activity systems. Using the joint activity system as a second stimulus, participants located the sources of the problems in different elements of the activity. Table 7.1 below shows a summary of the analysis of the problematic situations. In the analysis of and write-up of the contradictions in Chapter 6, I slightly rephrased them to capture the essence of the problematic situations after in-depth analysis of the workshop data and as guided by CHAT's levels of contradictions (see Chapter 3, Section 3.4.3, and Appendix 2). Hence, Table 7.1 captures the analysis as described by research participants during BCCLW.

Table 7.1: Summary of Analysis of Contradictions

Problems	Cause	Historical events explaining some problems
1. Chitetezo Mbaula saves firewood and it retains heat, but it delays cooking. Despite that people are aware that the Chitetezo Mbaula saves firewood, they cook on TSF because they are used to cooking on the TSF or they do not have the interest to cook on the ICS.	-The design of the stove prevents air to circulate and hence the fire does not burn rapidly. - The flame is directed at the centre of the cooking vessel, and for big pots, the pot does not boil on the sides. -The pots rests are flat and this makes big pots unstable and slip when cooking. -People are delayed when they cook on the ICS because it does not provide them the speed required compared to the TSF. -People struggle when cooking *nsima* especially for many people or large families (above 4 or 5)	2013: The mould was changed and this changed the dimensions of the stove including height from shorter to longer to accommodate the hottest point of 18-24cm.
2. People need to save firewood by cooking on the ICS but they struggle when they cook *nsima* in large family sized pots on the ICS.	- The design of the stove does not match the way people cook *nsima,* the staple food of Malawi.	

3. The process for stove production is cumbersome (it demands more physical work, coupled with heavy and complicated instruments and tools used for production). However, the stove cracks on the upper door and this reduces quality, it creates user apathy in cooking on the stove, for fear the stove would break, and dilemma in the production group as they sell stoves with cracks. It is a difficult situation because sometimes the crack comes after cutting the door, sometimes it is visible after firing, and sometimes it is only visible when they start cooking on it.	-The crack may be caused by door cutting, as they may be tampering with the stove. -It may be the heat when firing the stove. -It may be because of lacking breathing space when they start cooking on the stove, because the stove design does not have enough space inside, and there is not enough space between the pot rests and the pot space. - It may be because the door has no balance, it is the weakest point of the stove that is why the crack is on top of the door.	
4. Potential users are not aware of how to use the stove, but sensitisation messages do not reach the potential users. Even though ways and means for sensitising the potential users exist, they lack someone to open them.	-There is lack of interest from the disseminating institution to sensitise the potential users and the community on stove handling, -Cooking demonstrations have not been conducted in the community since 2009 when the stove was disseminated in the community. -The stove promoters have too much work in promoting stoves and sensitising the community because most promoters have left.	2009: Eleven volunteers (promoters) start promoting ICS 2011-2012: The project which was paying the promoters phased out 2015: Two volunteers/promoters left in promoting ICS 2016: One promoter left in promoting ICS
5. Stoves are in demand but the stoves are not available in the community.	- The stove production process is cumbersome because every stage of the process demands more physical work and food. - Most members dropped out because of the labour intensity in production. -The price at which the stove is sold is low compared to the nature of the job and the general rise in price of (basic) goods, which contradicts with the outcome for stove production.	2009: members started dropping from production group. 2009: phone stolen from the owner of the house where stoves were produced. 2009: production group disintegrate. 2013: tools for stove production were changed, this included the mould from the bucket to pedal mould to reduce labour involved in production, but the mould remained heavy. 2014: three members left in production group. 2015: one member left in production group.
6. Pigeon peas are distributed as an incentive to promote stove uptake. However, the pigeon peas are sold before reaching the target beneficiaries (the potential and actual stove users including those who received a free stove from members of the production group and those who bought the stove); hence the chain for the distribution of pigeon peas is not reaching the target beneficiaries.	-There is no transparency in communicating to the community why pigeon peas were linked to the stoves, who is supposed to receive the pigeon peas, the amount to be received and how it is distributed. -Someone is not transparent in the handling of the pigeon peas and this brings doubts amongst the community members. -Beneficiaries receive varied amounts.	

| 7. Stove producers need to raise the price for the stove as the one offered is not enough compared to the general rise of commodities on the market, but the consumers are complaining that the price is high and that some cannot afford and that is why they do not have a stove. | - Stove production process is hard and the amount offered is quite little compared to the labour.
-Prices for basic commodities have gone high (for instance, you need to sell three stoves to buy a 5 litre bucket of maize) yet to produce one stove it takes more than 42 days (as indicated in Chapter 6, Section 6.3.29).
-The potential users also feel that all the materials for the stove production are locally sourced and not purchased, and producers do not need any capital when they start the stove business, therefore the price should not go up.
-For potential users it is difficult to find money because times are hard and they would rather use the K500 for supporting the family.
-Raising the price relies on the implementers to do a gross margin analysis. | -2013: government launches an initiative to roll out 2 million stoves by 2020, stoves need to be affordable to the poor population in order to reach the target.
-2008/2009: Gross margin analysis to determine price was done.
2014: Stove raised to K500
-The stove is not on free trade |

Source: Jalasi, 2018

The purpose of the historical analysis was to find major historical events that could explain the problematic situations in order to help participants in modelling of the solutions to the problems. However, as Table 7.1 indicates, participants did not find specific historical events that explained the origins of all the problems. Yet, they were able to explain the roots of the problematic situations (see Chapter 6).

After identifying and analysing the problematic situations, participants organised a meeting with the Field Facilitator who had attended the planning meeting to brief him on the progress made (see Appendix 14). After presenting the problems to him, he emphasised that the problems participants had identified are not unique to the case study, and that most places where they had disseminated the ICS experienced similar problems.

7.2.3 Modelling of solutions

After finding the causes and tracing the origins of the problematic situations, participants were ready to model solutions. It is worth pointing out that during the questioning and analysis sessions participants had already started proposing solutions. However, the researcher interventionist requested for a systematic approach in order to capture the essence of the learning process. Before proceeding with modelling solutions, participants prioritised five contradictions to continue with in the learning process. Interestingly participants left out contradiction 6 and 7. For contradiction 6, participants felt that it was related to contradiction 4. Hence, they agreed that the price would be raised eventually after organising a meeting between producers and consumers where the reasons for raising the prices would be

explained and an amount would have to be agreed upon between them; that is when stoves would be available. On the other hand, they left out contradiction 7 because it was sensitive as the issue involved the Group Village Headman and some senior people in the community (see Chapter 6, Section 6.3.3.3). Participants proposed a number of solutions. However, we had to examine the solutions before filling them in the solution column (see Section 7.2.4 and Appendix 14). Table 7.2 below provides the examined solutions.

Table 7.2: Solutions to contradictions prioritised

Contradiction	Solution
1. Satisfying the requirements for firewood saving and heat retention *versus* delaying cooking / (no speed in cooking (See Chapter 6, Sections 6.3.1.1- 6.3.1.3).	-The design should change in the following ways: (a) It should have more breathing spaces to produce strong-rapid-burning fire. (b) It should have holes at the base and lifted with pot stands at the bottom to create outlet for ashes. (c) The pot rests should be raised to allow airflow between the pot and the stove. (d) The body should be shorter to allow the flame reach the target-cooking vessel easily. (e) End-users should be sensitised on handling of the stove and use, for example, they should be sensitised on using small well-dried pieces of wood, and that the stove needs to face the direction from which wind is blowing.
2. Between the need to use an improved cook stove and struggling to cook *nsima* on the improved cook stove (see Chapter 6, Sections 6.3.1.4 - 6.3.1.5)	-The design should change to potentially allow for improvising support for the pot when cooking *nsima*, preferably a short body, because the tall body makes it difficult to improvise support for the pot.
3. Following a cumbersome quality control production process to produce quality stoves *versus* production of cracked stoves on the upper door that reduce quality of the stoves (see Chapter 6, Sections 6.3.2.1-6.3.2.4)	-There is need to find means to secure the stove to avoid the crack, for example, a metal curve around the door, the mould should come with already made door. -The disseminating institution should research into this, in order to find a solution to stopping the crack. -When cooking we should not put firewood in the spaces between the pot and the stove.
4. Availability of scripted effective approaches for promoting cook stoves *versus* lack of use of the available approaches to reach out to end-users and putting the end users in the periphery of cook stove sensitisation messages (see Chapter 6, Sections 6.3.3.1-6.3.3.2).	-Sensitisation meetings on the use and benefits of Chitetezo Mbaula should be convened. -Cooking demonstrations should be taking place in the community. -Role-plays should be included at sensitisation meetings sometimes in order to attract people to attend meetings. -There has to be interaction and collaboration between stove promoters, Village Development Committee and the stove production group, but the implementing institution should take a leading role. -Approaches and methods for stove dissemination and promotion should be re-examined.
5. Between the demand for stoves on one hand, and the unavailability of the stoves on the other hand, (see Chapter 6, Sections 6.3.2.5-6.3.2.8).	-The selling price for the stove should match the work involved in stove production. -Tools and instruments for stove production should be redesigned to be lighter in weight and to lessen the burden of work, for instance, the mould should come with ready-made door, a machine for mixing, and smoothing the clay soil should be invented. -There is need to encourage replanting of trees and designating land for the production group to access wood for firing stoves with ease in future.

Source: Jalasi, 2018

7.2.4 Examining solutions

After modelling solutions, participants moved on to examining the solutions. As indicated above, we completed this action before filling in the solution column as indicated in Table 7.2. Participants examined each solution in two ways, first by using four field dimensions of development, which allowed participants to choose best solutions by reflecting on the object their activity and to define the ZPD of their activity. The best solutions were those that would lead them to attain the ZPD (see Photo 7.1). The second way was to categorise the solutions in terms of weaknesses and strengths in view of overcoming the contradictions identified. Participants defined the ZPDs in four aspects basing on the analysis of the problematic situations and the proposed solutions.

(a) On the vertical axis, from conducting cook stove sensitisation meetings as part of other development meetings in the community **_to_** conducting cook stove sensitisation meetings on their own, and as part of other development meetings. On the horizontal axis, from only implementers and stove promoters to be responsible for promotion of ICS **_to_** community members, production group, VDC to take part in promotion of ICS but implementers and stove promoters to take the lead.

(b) On the vertical axis, from more fuel consumption, no heat retention, and fast when cooking **_to_** fuel saving, heat retention and fast when cooking. On the horizontal axis, from cooking _nsima_ in small pots, and pots with handles only **_to_** cooking _nsima_ in large pots and pots without handles.

(c) On the vertical axis, from cumbersome production process and tools **_to_** practicable or handy production process and tools. On the horizontal axis, from a cracked stove on the upper door that reduces quality **_to_** a quality stove without a crack on the upper door.

(d) On the vertical axis, from a cumbersome production process and tools, with very few enduring hardworking people to remain in production of stoves **_to_** a practicable or handy production process that many people should remain in production of stoves. On the horizontal axis, from scarcity of stoves that are unavailable for end-users **_to_** availability of stoves for end-users to purchase when needed.

Photo 7.1: Four plane dimensions of development for examining solutions (Chisoni, February 2016c)

I synthesised the different ZPDs into one, as depicted on the vertical and horizontal axis in Figure 7.1 below:
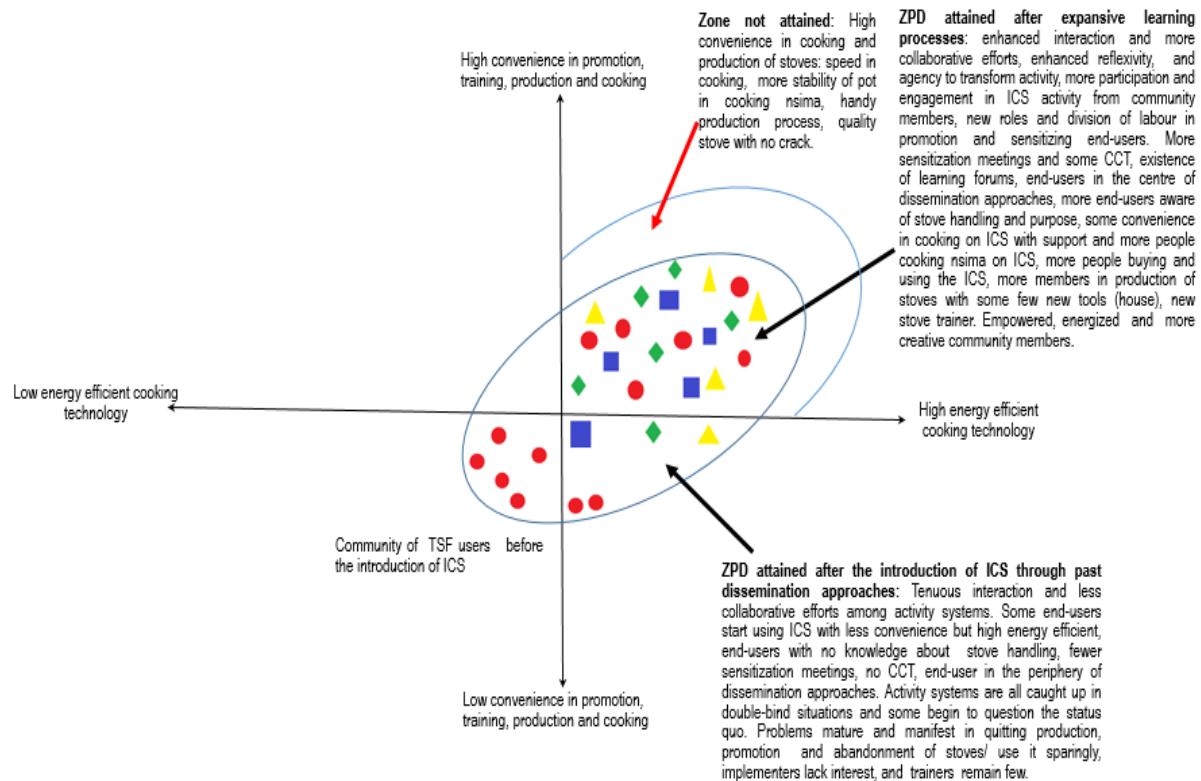
Figure 7.1: Zone of Proximal Development in ICS practice in Chapita village case study

Source: Jalasi, 2018
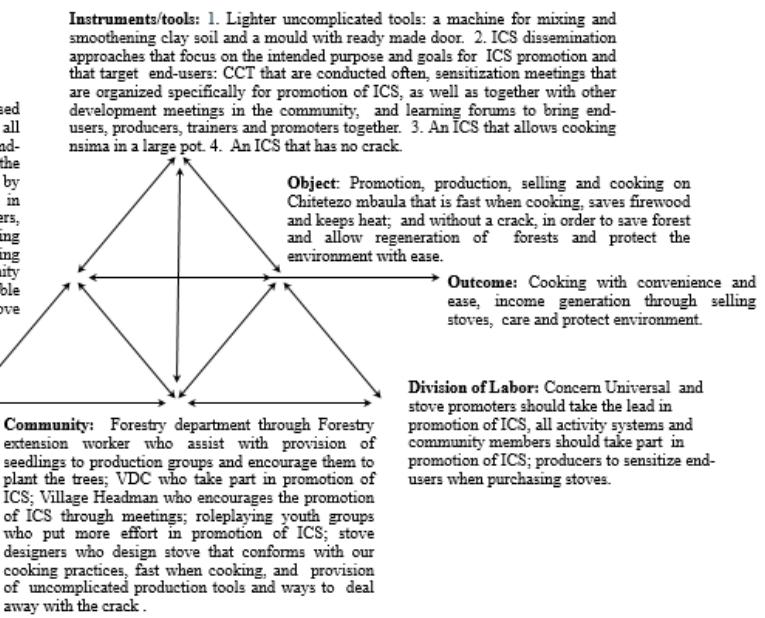
The solutions were further examined for their feasibility. Participants had to find out the support and obstacles in the implementation of the solutions (see Appendix 14). I also consulted the SEMU officer to discuss the feasibility of the solutions, especially for contradiction 1, 2 and 5 because they involved changing the design of the stove as well as the tools for stove production. He emphasised that it was difficult to change because the design had gone through several transformations and the current one, which was changed in 2013 was final. However, he recommended that we attend the Cleaner Cooking Camp 2016 (CCC) to convince and prove to the audience about the proposed design (see Table 7.2). After examining the solutions, participants created the visionary model as depicted in Photo 7.2 and reproduced in Figure 7.2 below:

Photo 7.2: Visionary model (Chisoni, February 2016c)

Instruments/tools: 1. Lighter uncomplicated tools: a machine for mixing and smoothening clay soil and a mould with ready made door. 2. ICS dissemination approaches that focus on the intended purpose and goals for ICS promotion and that target end-users: CCT that are conducted often, sensitization meetings that are organized specifically for promotion of ICS, as well as together with other development meetings in the community, and learning forums to bring end-users, producers, trainers and promoters together. 3. An ICS that allows cooking nsima in a large pot. 4. An ICS that has no crack.

Subjects: 1. Implementers: with increased interest in promotion of ICS: to reach out to all all activity systems, to specifically target end-users. 2. Producers: Hardworking, who follow the production process, who are role models by cooking on the ICS, who are involved in promotion of ICS. 3. Promoters: More promoters, who put more effort in promotion of ICS focusing on the intended purpose and goals, who bring together all activity systems and community members. 4. End-users: who are knowledgeable about the purpose and goals of using ICS, stove handling, and use the stove everyday.

Object: Promotion, production, selling and cooking on Chitetezo mbaula that is fast when cooking, saves firewood and keeps heat; and without a crack, in order to save forest and allow regeneration of forests and protect the environment with ease.

Outcome: Cooking with convenience and ease, income generation through selling stoves, care and protect environment.

Rules: New: 1. Producers must be involved in promoting stoves and sensitizing end-users on handling of ICS, purpose and goals in collaboration with promoter; 2. Implementers must be on the fore front in advocating for ICS that conforms with the Malawian traditional cooking practices. **Old revitalized:** 3. The production process must be followed properly. 4. The stove should face the direction from which wind is blowing. 5. Only use dry and small pieces of wood.

Community: Forestry department through Forestry extension worker who assist with provision of seedlings to production groups and encourage them to plant the trees; VDC who take part in promotion of ICS; Village Headman who encourages the promotion of ICS through meetings; roleplaying youth groups who put more effort in promotion of ICS; stove designers who design stove that conforms with our cooking practices, fast when cooking, and provision of uncomplicated production tools and ways to deal away with the crack.

Division of Labor: Concern Universal and stove promoters should take the lead in promotion of ICS, all activity systems and community members should take part in promotion of ICS; producers to sensitize end-users when purchasing stoves.

Figure 7.2: Visionary model of ICS activity system
(Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003)

7.2.5 Experimenting with the new model

In order to guide the experimentation of the solutions, I broke up the solutions into manageable tasks. Participants chose tasks to experiment on in the following month as indicated in Table 7.3 below. Participants formulated task forces on each of the tasks, and a cook stove organising committee to steer the transformative agenda. Then they came up with action plans to complete the tasks. Table 7.3 below summarises the action plans. (See also Appendix 17, Chapita Village case study).

Table 7.3: Summary of tasks for experimentation of solutions

Task description	Action
1. Changing the design of the stove in response to contradiction 1, 2 and 3 and tools for production in response to contradiction 5	Representatives from BCCLW to present the contradictions and solutions proposed at the CCC 2016, take notes of feedback received and report back to the participants of the BCCLW
2. Sensitization meetings in response to contradiction 4	To organise sensitisation meetings on 8 and 29 March 2016 for all community members
3. Conduct Controlled Cooking Tests (CCT) (demonstrations) in response to contradiction 4	To conduct two cooking demonstrations on 8 and 29 March 2016
4. Planting trees in response to contradiction 5	To buy seedlings, organise people to collect and plant seedlings at their homes, to be announced at the meeting 8 and 29 March 2016
5. Organise learning forums	To search for ICS users as role models, to bring together all the activity systems, to share experiences, challenges and ways of overcoming challenges in cooking on ICS, meetings to be held on 8 and 29 March 2016.
6. Revamping stove production group	To organise community members both old members of the defunct production group and new, and brief them on the learning processes occurred, the visionary model and the intention to revamp the group and find all necessary stove production materials before 8 March 2016. ● 19 Feb 2016 house roofing for stove production ● 20 February 2016 first meeting ● 22 & 24 February 2016 collecting clay soil ● 11 & 12 March 2016 making stoves and agreeing for next production ● 8 & 29 March 2016 meetings

Source: Jalasi, 2018

After participants developed action plans, taskforces and a cook stove committee, I developed duties for the committee before I left the field.

7.2.5.1 Duties for cook stove committee in Chapita Village study site

1. To coordinate the six taskforces and the tasks.

2. To receive reports from the taskforces and keep them safe.

3. To link up with researcher interventionist and report on progress of various tasks through the research assistant.

4. To link up with Field Facilitators at Concern Universal and brief them on the progress of cook stove activities once a month.

5. To encourage and promote all activities taking place in Chapita village.

6. To oversee that all activities are running smoothly, and when any problems arise, to call for a meeting, discuss and find solutions, or ask the Field Facilitators from Concern Universal or the researcher interventionist.

7.2.6. Reflection and consolidation of the new practice

Reflection and consolidation of the new form of activity took place about four months after the last session of BCCLW. Before explaining how research participants carried out the actions of reflection and consolidation, I report on the progress of experimentation processes on the six tasks. Then I will report on further development that had taken place after consolidation of the new form of activity.

7.2.6.1 Progress on the tasks

As indicated in Chapter 3, Section 3.7.6, during the first follow-up visit about a month later, participants had started experimenting on some aspects of the new model. In the process, they discovered emerging problems because some aspects of the old model of activity had not changed. Virkkunen and Newnham (2013) observed that when research participants carry out the new kinds of actions within the context of the existing activity system, they are bound to experience disturbances and problems caused by contradictions between the new and the old principle of carrying out the activity (p. 77). The main issues emanated from the design of the stove and the tools for stove production, which included lack of house for stove construction and kiln for firing stoves, among others. In addition, the price for selling the stove had not changed, the production process remained cumbersome because the tools were still heavy and complicated. Participants deliberated on the problematic situations and devised plans on how to deal with some of the problems.

During the meeting, participants received feedback from the CCC 2016. This was the first task in the experimentation of the new model. The main issue was that the proposed design would compromise fuel efficiency, the very primary concern for the stove design; the stove was designed specifically to avoid too much airflow (see Chapter 6, Section 6.3.1.1). Another issue was that we were given the mandate to come up with stove innovations (featuring our proposed solutions), which could be tested to fit the standards of ICS. This was beyond the scope of the study. It may however, constitute post-doctorate work. In terms of the crack, remarks from the CCC 2016 indicated that the cause was not well established; hence, it is difficult to find a solution (see Chapter 6, Section 6.3.2.1).

Due to the feedback from the CCC 2016, participants, in response to contradiction 2, practically experimented cooking *nsima* with support (see Chapter 8, Photo 8.3) after follow-up workshops (see Appendices 11 and 15). This indicates how research participants' agency evolved to transform their activity. Initially the participants had not supported the idea of cooking *nsima* with support during BCCLW (see Section 7.2.2). However, by reverting to the idea participants 'explicated' an unacknowledged potential in the activity (Engeström, 2011) (see Chapter 8, Section 8.2.1.1). They brought it to the fore as

a source of new possibility in the cooking activity. This is a type of transformative expression (see Chapter 3, Table 3.2 and Chapter 8, Section 8.2.1.1).

Three sensitisation meetings took place in the community in 2016. However, CCT took place only once at one of the sensitisation meetings. This was because they had no money to purchase food items to conduct more demonstrations. Through CCT community members became aware that food items that take longer to cook such as beans are faster on the Chitetezo Mbaula, and hence using ICS for foods that take longer to cook saves more firewood. Additionally, at one of the meetings, research participants incorporated the learning forum since it was difficult to invite people separately for different events in a short period of space due to poor attendance. Participants had observed that attendance was good at the first meeting, but was poor at subsequent meetings. For the learning forum, research participants had invited four ICS users to share success stories; however only one woman shared her story. Even though she had mentioned about two challenges that she encountered (that the stove delays cooking and it is difficult to cook *nsima* in a large pot), many community members bought stoves right away. This is because her story had demonstrated the importance of using the stove, over the challenges encountered. It is important to note that implementers never attended any of the meetings as promised.

Apart from organising sensitisation meetings, learning forums and CCT, research participants had bought 145 acacia seedlings and distributed them among members of the stove production group to plant them at their homes for watering and management. Some members never collected their seedlings and they dried up. The Chief rescued some trees; she took the initiative to plant 15 trees. Unfortunately, armyworms destroyed some trees and only few survived (see Photo 7.3).

Photo 7.3: Acacia tree for firing stoves in future (Chisoni, June 2016b)

The last task was to revamp the stove production group, produce stoves, and make them available for end-users within and outside the case study area. In order to carry out the task, research participants elected a committee to lead the production group. Twenty members joined the group (see Photo 7.4); 16 were new members and four were old members of the defunct group. After training the new members, they produced 120 stoves for the first cycle. These were fired and sold (see Photo 7.5). Later they produced a second cycle; they also managed to fire and sell them. However, they used *njanji* as an improvised kiln because, as indicated earlier, the old kiln was out of order. Several problems emerged in the experimentation of the task. Most of the problems emanated from the old form of activity. They were related to tools and the outcome of the stove production activity system. As discussed in Chapter 6, Section 6.3.2.5 (see also Table 7.1), these were some of the problems that led members to drop out of the production group. For example, between the last session of BCCLW and follow-up workshops, five members had dropped out of the production group.

Photo 7.4: New stove production group (Chisoni, March 2016b)

Photo 7.5: Newly produced Chitetezo Mbaula, before firing (left), after firing (right) (Chisoni June 2016b)

7.2.6.2 Further development after consolidation of new form of practice
Some development took place in the community after consolidation of the new form of practice. As indicated in Chapter 3, I conducted follow up dialogues with a few members to track the outcome of the

expansive learning processes after consolidation of the new form of activity. This report is based on data collected from the follow-up dialogues. I present the developments as a summary in Box 7.1 below.

Box 7.1: Expansive developments after consolidation of new form of practice

1. Even though implementers did not attend the sensitisation meetings or organised one in the community, they conducted a training session at Chapita, for stove trainers from Balaka district. They used the clay soil that the newly revamped group had collected, which initially they alleged was of poor quality.
2. The implementers (through the old trainer) picked one **new member** of the stove production group as a trainer because she had demonstrated her skills during the training conducted as part of the experimentation process. She was involved in training others outside the research project area.
3. The implementers brought two wheelbarrows for the stove production group.
4. The implementers took ten members of the production group who had remained active to an educational visit at one stove production group to learn best practices.
5. A stove production house was built. However, research participants expressed concern about its small size (see Photo 7.6) and felt that someone must have misappropriated funds. As a result, by December 2016, nobody had started using it for stove production because members were disappointed with the development.

 Source: Jalasi, 2018

The development (as described in Box 7.1) indicates how interaction was expanded among activity systems, specifically, between the implementer activity system and the other activity systems who participated in the BCCLW. However, failure to attend and /or organise sensitisation meetings and CCT to reach out to end-users, indicated that the interaction between the two activity systems was still tenuous. As indicated earlier, the implementers were absent during workshops, except for the planning meeting and consolidation session. There was not enough time between the completion of BCCLW and follow-up activities because of the limited time available to complete the study. Hence, the development in Box 7.1 also echoes that expansive transitions take a long time, often in several cycles (Sannino, Engeström & Lahikainen, 2016) which require lengthy follow-up periods in order to track the sustainability of ideas and actions taken (Haapasaari et al., 2016, p. 258). The progress on the tasks and the developments that had taken place after consolidating the new practice, could be taken as the first cycle of expansive learning.

Photo 7.6: New house for stove construction (Jalasi, March 2017)

7.2.6.3 Reflection on the learning process

Before consolidating the new model of activity, participants reflected on a number of issues (see Appendix 15). However, in this section I include reflections that relate to the research question addressed in this chapter and the overall goal of the intervention, which is transformative praxis. I will also focus on the main issues on each of the topics discussed in summary form (using participants' own voices) as shown in Table 7.4 below. I have discussed the details in Chapter 8, using research participants' direct speech (see Sections 8.2.1.1, 8.2.1.2, 8.2.2.1 and 8.2.2.2).

Table 7.4: Participants' reflections on the expansive learning process

	Participants' reflections on the expansive learning process
How and what participants learnt	The absence of implementers has taught us that we should not take one person's ideas as correct, but we need to *'experiment'*. This was in connection with the allegations that the implementers had expressed about the poor quality of soil as a reason for tenuous interaction with the stove production group, which was proved incorrect by experimentation (see Section 7.2.6.5).
	When we had started, our activity had problems but the *'experimentation'* of the solutions such as meetings has helped us to see practical changes.
	I have learnt about working together and enhancing interaction.
	Others have learnt through this process that the stove is important especially through CCTs (a form of *experimentation*).
	When we have a problem, we should discuss and find a way forward to solve problems.
	When we correct a problem, there is usually another problem that comes in, that also needs to be corrected (problems do not end), we need continuous examination of problems.
	Learning is continuous.
	We need to look at several angles of the problem when solving the problem.
	We know and understand how to solve problems.
	When we solve problems, we need to think about sustainability of issues – to look into the future.
Things that supported the learning process	Meeting closely at these meetings helped us to think about issues properly.
	Your questions helped us to understand issues.
	People were flexible in contributing.
	Participants were allowed to express their ideas.
Things that hindered the learning process	The absence of the Field Facilitator from Concern Universal (the implementer activity system).
	The long hours of working
Possibilities clearly seen in the implementation of the new model	Enhancement of interaction among actors
	It is possible to revamp stove production.
	It is possible to spread the ICS technology further.
Problems clearly seen in the implementation of the new model	Dropping out of stove production group members
	The procedure for selling stoves is not followed.
	Some people still not keen to use the stove because it is slow
Resources identified for the implementation of the new form of activity	Forestry extension worker to collaborate with community members in provision of tree seeds, so that the stove production group should have a woodlot for firing of stoves
	Tiyanjane Chitetezo Club to develop a fund for transportation of stoves to the market
	Increase of production of stoves in order to find money for transportation of stoves, in collaboration with the promoter
	The Tiyanjane Chitetezo Club members to take ownership and lead in all activities
	Concern Universal should assist with stove production materials
	Researcher should assist in contribution towards a house for stove production
	The Village Headman should allocate a place for building a house for stove production and should help with sourcing of bricks for house construction through Village Development Committee.
	Member of Parliament and Group Village Headman should be approached for assistance.
	To write a proposal to the government to seek assistance for construction of house and kiln through the Forestry Extension worker

Source: Jalasi, 2018

Participants reviewed the reflections in preparation for consolidation of the new practice. Some of the issues were dealt with immediately. For example, researcher made her contribution towards the building of the stove production house and the secretary of the stove production group listed the stove production tools and materials needed, wrote a request letter to the implementers, and the researcher passed it on to the implementers the following day.

7.2.6.4 Consolidation of the new model of activity

After reflecting on the learning process, participants consolidated the new form of practice. It is worth noting that the SEMU officer representing the implementer activity system was present for consolidation. As a result, the process took longer than expected because the ideas and actions agreed upon happened in their absence. Instead of consolidating the practice, participants engaged in the action of questioning. Three main issues were the focus of the questioning (a) changing the rule on who should sell stoves; (b) the use of *'njanji'* for stove firing (see Table 7.5); (c) who decides on the stove price and raising the price of the stove; and (d) allegations made by the implementers about poor quality clay soil from the case study site.

After a long deliberation on the issues, participants consolidated the new form of practice as depicted in Table 7.5 below. Research participants also developed a five-year roadmap as a substantiation of the expansive learning process (see Appendix 18). Two issues needed to be highlighted in the roadmap document:

(a) The roadmap was the means for spreading the new practice to others who had not taken part in expansive learning processes within and outside the project area.

(b) The establishment of the cook stove committee as a permanent committee among committees under the VDC in Chapita village.

Table 7.5: New form of activity

Elements of activity system	Old principle	New principle
Tools/ instruments	1. Cook stove sensitisation were done as part of other development meetings in the village. 2. CCT were not being conducted. 3. People were not aware on how to cook *nsima* in a large pot because there were no learning forums. 4. Messages about challenges that people encounter during cooking with Chitetezo Mbaula were not disseminated. 5. Sensitisation messages could not reach end-users because approaches to dissemination were not targeting end-users. 6. The stove production group had no fund.	1. Cook stove sensitisation meetings would be held independent from other development meetings once every three months, and as part of development meetings in the village. 2. During the sensitisation meetings, CCT would be conducted. 3. During the meetings, people would be showcasing how to cook *nsima* in a large pot without a handle by using a twig to support the pot. 4. Potential end-users would be sensitised on the challenges that they may encounter when cooking on Chitetezo Mbaula, for example, they have to be sensitised that the stove delays cooking when cooking food items that take between 15-30 minutes, such as

			nsima, tea, porridge. However, it helps a lot when you cook food items that take about an hour and more, such as beans, *thobwa*.[34] In addition, they would be sensitised that the stove would crack entirely, but the crack does not interrupt the cooking, and the stove would take a number of years to break with the crack. 5. Dissemination approaches and sensitisation messages would be targeting end-users because they are important in helping to achieve the object of the ICS activity 6. The stove production group would establish a fund to assist in transportation of stoves to the market and for conducting CCT, other activities and for buying food during stove production.
Subjects		1. *Stove producers* were only trained on how to produce stoves. 2. *Stove producers* dropped out of production group, they stopped producing stoves. 3. *Implementers* had less interest in promoting ICS in Chapita.	1. *Stove producers* should be trained in the same way as promoters about how to sensitise end-users on stove handling and purpose. 2. *Stove producers* should work hard and produce more stoves and stay in the group, and the group should be strong. 3. *Implementers* should lead in the promotion of ICS in Chapita and encourage the ICS activities.
Object		1. Promoting, producing and cooking on a stove with a crack on the upper door. 2. A stove that delays cooking foods that do not take long to cook on TSF. 3. Stove production is cumbersome and labour intensive.	1. Promoting, producing and cooking on a stove <u>*without*</u> a crack on the upper door 2. A stove that is fast in cooking any kind of food. 3. Stove production should be handy with lessened labour involved by changing tools for stove production.
Rules		1. Producers were not allowed to sell stoves. 2. Producers were not allowed to teach end-users on stove handling, its purpose and importance.	1. Producers should sell stoves after the promoter has selected good stoves, but a stove that has broken pot rests should not be sold. 2. Producers should teach end-users about stove handling, purpose and importance.
Community		1. Stove designers designed a stove which overlooked the traditional way of cooking, especially *nsima*. 2. VDC and Forestry extension worker were not much involved in promoting ICS in the village.	1. When they design a stove, they should prioritise traditional ways of cooking, especially *nsima.* 2. VDC and Forestry extension worker, in collaboration with the Village Headman, should take part in the promotion of ICS and encourage producers and end-users through meetings.
Division of labour		1. There was no Cook stove committee in Chapita village.	1. Established Cook Stove Committee in Chapita village. 2. Implementers and stove promoters should take the lead in sensitizing people on ICS, and all the groups in the village should take part.
Outcome		1 Cooking *nsima* on the ICS with difficulties. 2 Cumbersome stove production that does not match with the selling price of the stove and the outcome for pursuing the activity.	1. Cooking *nsima* on the ICS with more convenience, ease, and pleasure. 2. Stove production that is handy, but more importantly the labour should match the selling price of the stove in order to realise the outcome for engaging in the activity (to provide the basic needs of our families).

Source: Jalasi, 2018

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[34] *Thobwa* is a Malawian drink that has a milky appearance, a cereal taste, and a grainy texture. It is made from white maize, millet, or sorghum and is popular in all parts of the country. The name *thobwa* means "sweet beer" but it is non-alcoholic.

7.2.6.5 Germ cell generation

As indicated earlier (see Chapter 3, Section 3.5.2), the theory of expansive learning is based on the principle of ascending from abstract to concrete (Sannino et al., 2016a and Engeström, 2015). It involves production of an idea or concept, initially in the form of an "abstract simple explanatory relationship", which is a "germ cell" (Engeström, 2015, p. xx). In this case study, the initial abstraction was the idea of "experimentation". In Chichewa language, this idea may be expressed differently, depending on the context. One may use *"kuyesera"* which translates as "trying out something to see if it works or not". Another way of expressing the idea is *"kuona"* which is "to see". For example, in a context such as "I would like to see if this works". Other ways of expressing the idea include *"ndi zotheka…"* meaning, "it is possible…", "titha…" "we can…". In the latter two examples, the key words *"kuyesera"* or *"kuona"* may not appear in a sentence because of ellipsis.

The researcher interventionist, in explaining the expansive learning cycle, introduced the idea of experimentation. Research participants took this up early during questioning sessions and it energised the expansive learning process. When research participants wanted to prove whether some of the ideas that others suggested would work in the process of deliberations, they used the expressions described above and several other versions. In some cases, they expressed this with the intention to prove someone wrong, or to disprove an idea. One example I would like to highlight was regarding the idea of cooking *nsima* with support. Some research participants felt that it would break the stove since it was made of clay (see Chapter 8, Section 8.1.1.1). At some point, some participants proposed that it would be better to experiment to see what would happen. The following exchange between participants provides evidence:

> **Participant DC:** *The way she explained about the support she uses on the pot, it could have been possible to inform others that when you struggle cooking nsima in a pot without a handle **try** this. …. (BCCLW BK2)*

> **Participant RB**: *That is where the main issue is – it is on the stove because you know the stove is made of soil, and imagine I take a twig, do you know what a twig is? … it is a piece of wood. … So I take a piece of wood, I put it against the stove like this, … how many days will the stove last before it breaks? (BCCLW BK2)*

> **Participant RK:** *I would like to agree with my fellow elder, the stove could break. Moreover, she (name of person) is talking about a small amount of nsima, not nsima for a large family, it can't be possible. (BCCLW BK2)*

> **Participant SB:** *But I cook nsima in a big pot without a handle, and I manage without problems because I am used to it. (BCCLW BK2)*

> **Participant EC:** *It is still **possible** to cook without support. We will **try** to cook on the 15th. (BCCLW BK2)*

> *Participant SB: I really feel that if it were not that this (workshop) is about schooling, I could suggest that we conduct an **experiment**. We could take flour, a big pot, and a stove with some firewood and **experiment**.* (BCCLW BK2)

Thus, from my analysis the concept "experimentation" was the germ cell. It became concretised in practical experimentation with the problematic situations. It became the catalyst for completion of tasks during experimentation processes. For example, the implementer had initially alleged that Chapita production group had poor clay soil. (See Chapter 8, Section 8.2.1.2, # 7703-7704.) In order to challenge the allegations (and indeed as part of resolving the contradiction related to scarcity of stoves) (see Table 7.2), participants experimented with the soil and produced stoves. This was evidenced through comments research participants made during the visit in the community to follow up on the experiments:

> *Participant ECH: There is not even a trace to show that the clay soil is poor.* (FUCV BK1)

> *Participant FK: Not even one.* (FUCV BK1)

> *Participant ECH: There is something that they [implementers] are not telling us (but it is not about clay soil). However, we are continuing with production. …. We know our clay soil is good. … if he (SEMU officer) came to see, he would be embarrassed about his allegations on the poor clay soil.* (FUCV BK1)

The comment from *Participant ECH* above also resonates with my earlier argument that research participants used 'experimentation' in some situations as a way of proving someone wrong. However, this became a springboard for engaging in transformative actions.

The concept of 'experimentation' also triggered agency in research participants who were present during experimentation processes. For example, some research participants explicated new possibilities or potentials in the activity, by relating to the past positive experiences (Haapasaari et al., 2014) of cooking *nsima* on TSF using some support bringing it to the fore as evidence of unacknowledged potential for the new cooking technology:

> *Participant ECH: What we are doing here is similar to what we do when we cook on the three stone fire, when we reach a certain point we find some support, it is not only on the stove (ICS).* (ES BK1)

> *Participant AI: It is **possible** to cook nsima on the stove in a large pot!* (ES BK1)

Similarly, when the video (as an instantiation of practical experimentation) on cooking *nsima* with support was shared with practitioners from the Alternative Energy Section, they related the cooking of *nsima* with support to past positive experiences when cooking *nsima* on TSF in a similar way to *Participant AI* above.
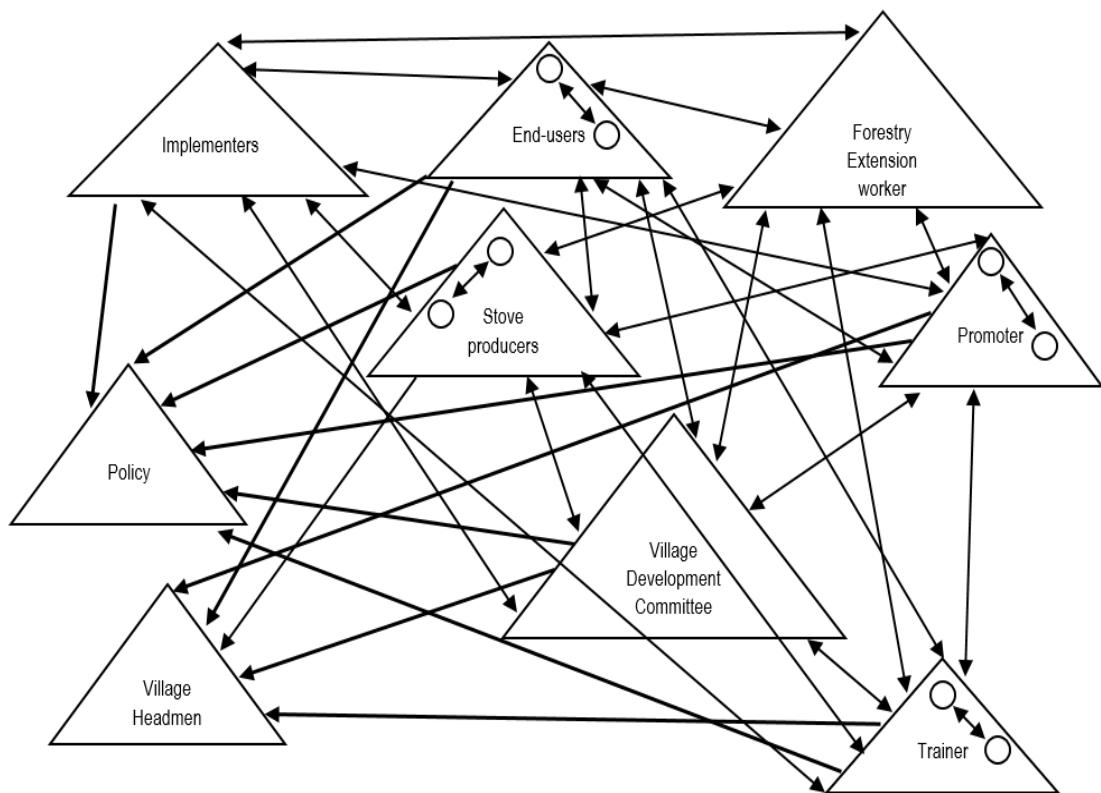
The idea of experimentation had generative potential, apart from evoking agency in research participants; it brought a feeling of empowerment and possibility in undertaking their activity. Participants used the concept 'experiment' during follow-up workshops as a catalyst for expansive learning. I have captured some of the ideas in Section 7.2.6.3. Here, I highlight two examples:

Participant SB: What I have learnt is that when we started this learning process the implementers were not available they had shown no interest in us [in our work]. They alleged that Chapita has poor clay soil for stove production. But I said no, if you remember. Now we have produced stoves and you have seen on your own that the allegations were not true. Is that soil from Chapita good or bad? You can tell us through your observation. If that soil was bad, we could get nothing out of that. All those stove could have disintegrated. So, what I have learnt is that most of the times we should not follow one person's ideas, but **experimenting** *helps. If we had believed that the soil is not good, let us just leave it, we could have lost this opportunity. (FUW BK1)*

Participant RK: I just wanted to add that this learning process is helpful because we women from Chapita we could have been demotivated because they [implementers] were saying the soil is not good. … This activity would have failed to progress, but because we had the courage – let us **experiment and see –** *as a result the implementers will be embarrassed. We have witnessed beyond doubt that our clay soil is good for stove production. (FUW BK1)*

7.2.7 Summary

Expansive learning processes in Chapita expanded learning interactions among other activity systems beyond the network of the interacting activity systems that I worked with at the beginning of the study. In Chapter 5, I presented the existing learning interactions before expansive learning processes (see Figure 5.19). Figure 7.3 below depicts expanded learning interactions after carrying out expansive learning processes. Some members of the community engaged in a learning process during experimentation processes, despite that they did not participate in BCCLW. Figure 7.3 identifies the learning subjects and the nature of interaction. The arrows identify the learning subject in each interaction. The connected cycles within the triangles indicate learning interactions between subjects of an activity system. While in Figure 5.19, no learning interaction occurred between implementers and policy makers, in Figure 7.3 policy makers learn from implementers. Notice also the shift in directionality of learning interaction from unidirectionality in Figure 5.19 to bi-directionality in Figure 7.3.

Figure 7.3: Expanded learning interactions in Chapita village case study

Source: Jalasi, 2018

Expansive learning processes enhanced collaboration among activity systems. (See also Chapter 8.) Participants were able to define the shared object and worked together to identify contradictions in the joint activity, modelled solutions and implemented the new form of activity. Sannino et al. (2016) remarked that successful expansive learning processes lead to new forms of activity. In the foregoing discussion, participants were able to design a new form of practice that they would want to achieve in the next five years. They aimed at overall transformation of the object of activity and model of the activity (see Table 7.5), but in many instances they only managed to make practical improvements (see Chapter 8, see also Chapter 9, Figure 9.1). This may be in part due to the nature of activity, especially in terms of technology design, and the absence of implementers during BCCLW. For instance, participants only managed to take few expansive steps by presenting their proposed stove design to the team of experts at the CCC 2016 (see also Chapter 9, Figure 9.1). This and other aspects of the new form of activity require continuous processes of working out and resolving contradictions in the ICS activity.

Evidence from this case study therefore indicate that DWR, using BCCLW as a tool kit, in the implementation of formative interventions can be used successfully as an approach to dissemination of socio-technical innovations. It can be used to evoke agency and enhance reflexivity in research participants (see Chapter 8), and build a sense of ownership, which is crucial in sustaining learning

towards sustained uptake and utilisation of ICS. During the deliberations, it was also possible to see how participants were moving towards collaboration in their work. In Chapter 8, I will discuss how this took place.

Community members were energised to resolve contradictions in the joint activity. Most importantly, they were able to identify the root causes of the problems, and dealt with them at that level, rather than dealing with the manifestation of the problems. However, some solutions required financial resources. This was problematic due to the socio-economic status of the community as described in Chapter 1. The identification of resources required for the implementation of the new form of activity was therefore a necessary step in the expansive transition.

7.3 Expansive Learning processes in the Waziloya Makwakwa Village case study

Facilitation of BCCLW in Chapita case study provided me with experience in how to plan, prepare, and implement the workshops. Having successfully implemented the workshops, I decided to adopt the same approaches for the Waziloya Makwakwa case study. Sessions and tasks were planned in similar ways; however, there were few differences in the way research participants progressed during sessions (see Appendix 14).

In Waziloya Makwakwa, I facilitated BCCLW nine months after the ethnographic data collection. I started with a planning meeting, which was held on 22 February 2016, 14 days before the commencement of the BCCLW. Within the two weeks, both the research participants and I had time to prepare for the workshops. I used the time to analyse the outcomes of the planning meeting before facilitating the workshops. I then conducted BCCLWs as outlined in Chapter 3, Section 3.7.5.1 (see also Appendix 11). During the four days, I conducted eight sessions, with two sessions in a day. Each session lasted approximately three hours. However, some sessions were longer than three hours. This was due to the language problem, as explained in Chapter 3. In most sessions, the Field Facilitator had to interpret my explanations to the research participants. At times, I was repeating myself several times trying to explain ideas in different ways to make sure that participants understand. The workshops included 12 participants, representing five activity systems, implementer, stove construction group, ICS user, TSF user, and TSF and ICS user. We also had a CADECOM project chairlady. The project officer and project manager who were present at the planning meeting did not attend the BCCLWs. For follow-up workshops, new participants joined. On the first day of the workshop, we had a Health Surveillance Assistant from Ehlonipeni area. On the second day, we had a Forestry Assistant from Mpherembe and the Project Officer from CADECOM joined in one of the sessions.

7.3.1 Identification of a shared object

Identification of the shared object took place during the planning meeting. The purpose of the planning meeting was to provoke participants to recognise the need for change and potentially commit to the development of the activity, to allow participants identify a shared object, to introduce the BCCLW process and come up with a plan on how to conduct the workshops. In order to accomplish this, I mirrored some problematic situations from interview data and requested comments from the participants. Participants were keen to engage in the learning process in order to find solutions to the problematic situations identified from the mirror data. I also introduced the BCCLW process and a few instruments, including the phases of the Change Laboratory process and the model of activity system. Participants identified a shared object as follows: *Successful dissemination, construction, and cooking on the improved (three place) fixed cook stove in order to protect and allow regeneration of forests, speed up cooking, reduce time spent in collection of firewood and smoke-induced diseases, achieve health and sanitation, and encourage men to take part in cooking.*

The shared object is described in the project outline. The project outline also describes participants' commitment to carry the intervention, scheduling and timing of the workshops, participants who attended and other logistics (see Appendix 7). It was the main outcome of the planning meeting.

7.3.2 Analysis of contradictions

Analysis of contradictions started with presentation of mirror data of problematic situations. This took place mainly in the first session of BCCLW (see Appendix 14). The analysis proceeded with historical analysis and analysis of activity systems (in session 3 and 4). I used mirror material as the first stimulus. The mirror material aroused some debate among participants. Some problematic situations and scenarios triggered a conflict of motive. For example, the issue of stove construction as voluntary work, versus income generation activity (see Chapter 6, Sections 6.4.4.1). Participants felt that the generation of income from the activity was going to contradict with the goal of the project to reach out to poor communities. At the same time, it was going to affect spreading of the ICS activity to other areas, as well uptake of ICS.

> **Participant FC:** *What we want is that people should take ownership and understand that this development is important …. But if you construct for them for money, then the person may not use the stove because they have not understood its importance …. The way I see it if we charge, then we would reduce the uptake of stoves because many people will be saying, it needs money, and we don't have money.* (BCCLW MZ2)

> **Participant AK:** *This is a difficult situation because the project is intended to assist the most vulnerable groups in the community, so the issue of charging the stove is problematic because the most vulnerable cannot find money for stove construction.* (BCCLW MZ2)

Participant MN: But so many people approach us stove constructors requesting for the stove. They say we also need the stoves, how can you help us. So we explain to them what they should do [collect all construction materials]. Then they say we cannot manage to do that. Is it not possible for your group to come and construct for us, and we can pay you? So we had hope that if we can go as a group we can construct and find some little money. But so many people request us. (BCCLW MZ2)

Participant DC: … many people need the stove but the problem is to collect the construction materials. The problem is that on our own we cannot go to construct them the stove free when they sit at home and do not want to participate in the CADECOM meetings. So we go and make them a free stove? It is difficult. I am one of those who say no, I cannot. But if they can understand and ask us, then we can benefit a lot in future … they pay a little money which may not last for many days [if they use it on other things], but for the stove if they pay 1500 (kwacha) then they can use it for longer. … now the problem is that only few people understood [the importance of stoves], and own stoves, and use them … Most people don't want to collect the materials because they say it is difficult. (BCCLW MZ2)

Another example was the lack of kitchens in the communities, where participants observed that the requirements for the kitchen to achieve sanitation also jeopardised uptake and use of ICS. Using the joint activity system as a second stimulus, participants located the sources of the problems in different elements of the activity. Table 7.6 below shows the summary of the analysis of the problematic situations; it captures the analysis as described by research participants during BCCLW. However, in the analysis of and write-up of the contradictions (see Chapter 6), I presented them in slightly different ways to capture the essence of the problematic situations after in-depth analysis of the workshop data. Further participants found explanatory principles for some of the problems identified as indicated in Table 7.6.

Table 7.6: Summary of analysis of contradictions

Problems	Cause	Historical events explaining some problems
1. Between the need for *ndhulani,* material used for constructing a durable fixed stove and the scarcity of the material in the study site and surrounding areas resulting to user apathy in collecting materials for stove construction, leading to low uptake of stoves	-*Ndhulani* regenerates slowly; when you dig up *ndhulani* it takes a year to rebuild. -Geographically, this area is not favourable for *ndhulani*. *Ndhulani* is usually found in marshy areas and the project site is up land, as result *ndhulani* is sparsely available. This situation is worsened because demand for stove construction is growing; additionally the amount required for construction of one stove is one full 20 litre bucket which may contribute to increasing demand. *Explanatory principle: The CADECOM project used successful project syndrome (see Chapter 6, Section 6.4.1.1); they transferred the project to the study site area upon it being successful in another area where they implemented the project without doing a contextual analysis on the availability of construction materials.*	2013: stove project moves to Ehlonipeni area 2014 – implementers notice low stove uptake
2. Between the need for cow dung a material used in stove construction to make the stove retain heat, in order to use less firewood and the	-A few people own kraals in this area and those who own have few cattle. As a result, end-users travel long distances to collect cow dung. - Cow dung is used as fertiliser in the gardens; hence, it is not free. The owners demand some money or they demand exchange in labour that the women should go and graze the cattle in exchange for the cow dung. This becomes a problem because it is customary for the men to graze	1980: tsetse flies affect places around the study site and cattle die

scarcity of the material in the study site resulting in user apathy	farm animals, yet it is usually women who search for materials for stove construction. _Explanatory principle: The Ngoni ethnic group is associated with rearing of cattle; however, few households have cattle in this Ngoni tribe. Participants sought an explanation as follows: This area is close to Vwaza Marsh Game reserve, and around 1980s tsetse flies inhabited the area, which infected cattle and resulted in loss of cattle because of Bovine trypanosomosis (see also Bovine trypanosomosis, n.d.). Since then, households have been trying to replace the cattle; however, due to high prices of cattle, this has been difficult. The CADECOM Field Facilitators also indicated that they used the successful project syndrome; they did not pay attention to the availability of local materials required for this stove type, they only looked at how successful it was in their previous project areas and assumed it was going to work in the study site._	
3. Between the requirements for construction of stove in a well thatched permanent kitchen as part of the Integrated Community Development project, that addresses household hygiene and sanitation, nutrition, indoor cooking pollution, fuel consumption levels and the lack of clear processes for initiating kitchen construction in the project area	-Existence of a cultural practice of controlling children, to make sure that they share whatever food items they have gathered with parent in-laws, hence mothers-in-law invite their married children to cook in one kitchen with them, consequently the children do not see the need for constructing their own kitchens. Sometimes they construct temporary kitchens with grass walls to use for space heating during cold seasons, which does not correspond with the stove design because the chimney requires concrete walls. -The construction of a permanent kitchen requires distribution of roles between husband and wife. There is no collaboration in the division of roles for the task. This is due to laziness, particularly in men, associated with the culture of heavy and frequent drinking. The woman is left to take care of all household responsibilities. Since culturally, kitchen construction is a man's job, the woman may collect all kitchen construction materials, but still cooks outside. _Explanatory principle: Nowadays children are marrying whilst young, and sometimes they are not prepared to start a new family in terms of gathering the basic household items, such as pots, food, etc. Hence, parents feel the responsibility to continue looking after them by bringing them to cook in the parents' kitchen. Eventually, this becomes permanent not a transitional phase in most households. As a result, few permanent kitchens qualify for the construction of the stove._	
4. The need for the stove to retain heat for fuel efficiency versus the stove generating too much heat which is burning pots and dishes, despite removing firewood from the stove, and having enough water in the cooking vessel	-The pot that burns is the one in the middle cooking area. It may be because different sources of heat meet in the middle, hence too much heat is directed to one cooking vessel: (a) It is possible that the manure generates too much heat; maybe the measurement of the manure is more than the heat required. (b) The charcoal from the burning wood in the middle. (b) The burning flame from firewood in the middle. - It is possible that the holes that are supposed to direct the flame to the side cooking areas are small, therefore they do not take the flame to the sides, and instead it remains in the middle. - It is possible that the flame escapes through the spaces between the pot and pot rests if the stove was not constructed properly, allowing the heat from the flame to stay in the middle instead of distributing to the side cooking areas, contributing to too much heat. This could be because sometimes the stove constructors and the users do not understand how the stove works and they change some specifications. For example, they create three pot rests, creating space for the flame to escape from the top, yet some people ask the stove constructors to double the prescribed amount of cow dung. - It is also possible that the height of the stove is short and that makes the cooking target too close to the sources of heat generated by the three sources mentioned above. There is no standard height for the stove provided by the implementers.	2015: end-users report on scorching of pots

	- Implementers have no knowledge about how much heat the 20 litre bucket of cow dung generates; they have not conducted any experiments to understand how much time the stove can keep the heat and cook a dish on its own (without adding firewood) when it heats up.	
5. Stove construction as voluntary work to meet the requirement of stove affordability to the poor community versus the need for stove construction as a source of income to meet the stove construction group requirements, especially for food when constructing stoves, and the need to share the technology with others outside CADECOM clubs and project area to make a livelihood	-The construction group members are becoming few, this doubles the amount of work to be completed by one person, yet stove construction demands more physical work, requiring energy, yet they do not have means to organise money to buy food. -People outside the project area admire and need the stoves and request the assistance of the construction group from the study area, but they cannot do it for free. -People within the project area who do not participate in the CADECOM project activities admire the stoves but are lazy and/ or not willing to take part in the project activities, but they cannot construct free stoves. -People who participate in the CADECOM activities need the stoves, but are apathetic due to the scarcity of stove construction materials and the labour involved in individual collection of all stove construction materials; they approach the construction group for stove construction, but the materials collected are in short supply and the construction group cannot collect them for free. *Explanatory Principle: The stove is free in line with the objective of the project. Implementers are afraid constructors may turn it into a business.*	
6. The stove as source of space heating for households and a place for family gathering and sharing of stories and imparting indigenous knowledge versus stove providing space heating for only mother and father, excluding other members of the family, especially children	-The fixed type stove design means that a family cannot sit around the fire source. This, coupled with most kitchens being small and the stove taking more space, little space is left to accommodate children and parents to sit around the stove.	

Source: Jalasi, 2018

The purpose of the historical analysis was to find major historical events that could explain the problematic situations in order to help participants in modelling solutions to the problems. However, as Table 7.6 shows participants only found very few historical events to help them explain the origins of the problems. Nevertheless, they were able to trace the origins of the problematic situations through the explanatory principles. (See also Chapter 6.) Despite the scourge of the tsetse flies being outside the inception of the project, it explained why cow dung was scarce. Lack of historical events to explain the problematic situations could also in part be due to the developmental stage of the activity. By the time I conducted BCCLWs, the project was about two and half years old (29 months). After identifying and analysing the problematic situations, participants modelled solutions.

7.3.3 Modelling of solutions

After finding the causes and tracing the origins of the problematic situations, participants were ready to model solutions. As in the Chapita case study, participants started proposing solutions during the analysis sessions. Before proceeding with modelling solutions, participants prioritised four contradictions to continue with into the learning process. Participants left out contradictions 5 and 6. It was difficult to reach a consensus when it came to prioritising contradictions. For contradiction 5, implementers emphasised that the contradiction could be resolved without setting up specific tasks to resolve it. They indicated an oversight on their side that the construction group could charge when constructing the stove in specific situations. For example, when they construct a stove for members outside the project area, for those within the project area who do not participate in the project activities and for those who found it difficult to collect construction materials. They also acknowledged lack of awareness in the way the stove construction activity system was evolving and the conflict of motives it was triggering in the constructors. The third reason was that they were afraid of confusing community members with ambivalent messages. After a long discussion, participants agreed to put the contradiction as a way forward for contradiction 1. It is worth noting that the process involved going back and forth, not as reported here. This contradiction resurfaced on the last day of follow-up workshops (see Appendix 15) and participants proposed solutions. Similarly, it was difficult to reach consensus for contradiction 6. In the same way, implementers actively resisted modelling solutions to the contradiction because the problem emanated from the stove design and thus it may be necessary to change the design. In this regard, the participants expressed a form of transformative agency, *resisting change*. (See Chapter 3, Table 3.2.)

Participants developed a number of solutions. Then, we examined the solutions before filling them in the solution column (see Section 7.3.4 below and Appendix 14). Table 7.7 below provides the examined solutions.

Table 7.7: Solutions to contradictions prioritised

Contradiction	Solution
1. The need for *ndhulani,* a stove construction material responsible for durability of the stove *versus* the scarcity of the material in the project area (see Chapter 6, Sections 6.4.2.1-6.4.2.2 and 6.4.1.3)	*(a)To use clay soil used in moulding vessels and pots in place of ndhulani* (b)To reduce the measurement of *ndhulani* to half (10 litres instead of 20 litres)
2. The need for cow dung a material responsible for heat retention in the stove *versus* the shortage of cow dung in the project area (see Chapter 6, Sections 6.4.2.3 & 6.4.1.3)	(c)To use goat dung in place of cow dung (d)To reduce the measurement of cow dung to half (to address the shortage of cow dung).
3. The requirements for constructing the fixed type stove in a kitchen to address indoor air pollution, promote sanitation and hygiene *versus* lack of clear procedure for initiating and promoting kitchen construction (see Chapter 6, Sections 6.4.1.1 and 6.4.2.4-6.4.2.5)	*(e)Village Headmen should establish a code of practice regarding building of kitchens and stoves in the village.* (f)The code of practice should include stipulation about division of roles at home, specifically that men should take part in the building of kitchen and stoves in their households

4.	The need for heat retention to achieve the requirement for fuel efficiency *versus* generation and emission of too much heat (see Chapter 6, Sections 6.4.3.1-64.3.2)	(g)To inform and teach community members about the stove and how to use the stove *(h)To enlarge the holes in the stove that take the flame to the side cooking areas* (i) To increase the stove's height (j)To research how much time a pot would stop boiling after removing firewood from the stove in order to sensitise people on how much and for how long they can add firewood to the stove *(k)To reduce the measurement of cow dung to half (10 litres instead of 20 litres)*

Source: Jalasi, 2018

7.3.4 Examining solutions

As indicated above, we completed the action of examining solutions before filling in the solution column as indicated in Table 7.7. Participants examined each solution in two ways, first by using four field dimensions of development, which allowed participants to choose best solutions by reflecting on the object of their activity and to define the ZPD of their activity. The best solutions were those that would lead them to attain the ZPD (see Photo 7.7). The second way was to find weaknesses and strengths of the solutions in view of overcoming the contradictions identified. Participants defined the ZPDs based on the analysis to the problematic situations and the proposed solutions as follows:

(a) On the vertical axis, from low stove uptake (few people with stoves) *to* high stove uptake (many people with stoves). On the horizontal axis, from reducing cow dung and *ndhulani* when constructing stoves in order to reduce amount of heat retained and reduce durability of stoves respectively *to* constructing stoves with appropriate amount of cow dung and *ndhulani* to achieve appropriate heat retention and stove durability respectively.

(b) On the vertical axis, from low stove uptake *to* high stove uptake. On the horizontal axis, from constructing the stove only in the kitchen *to* constructing the stove on a veranda or in the shade.

(c) On the vertical axis, from too much heat generation from the stove *to* appropriate heat generation. On the horizontal axis, from scorching of pots and food but fast in cooking *to* no scorching of pots but fast in cooking.

Photo 7.7: Four plane dimensions of development for examining solutions (Chisoni, March 2016c)

I synthesised the different ZPDs into one, including those contained in the analyses during discussions and the shared object as depicted on the vertical and horizontal axis in Figure 7.4 below:
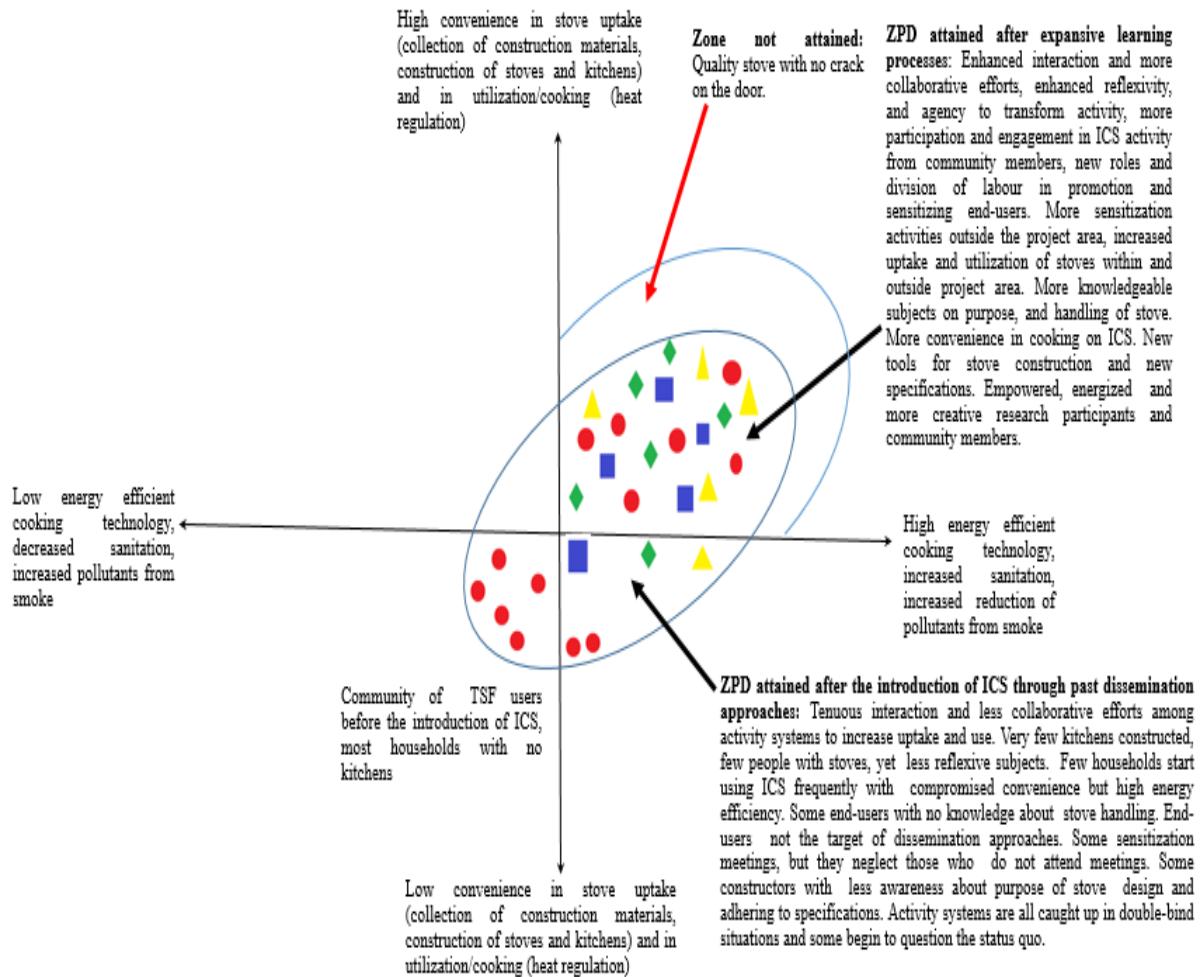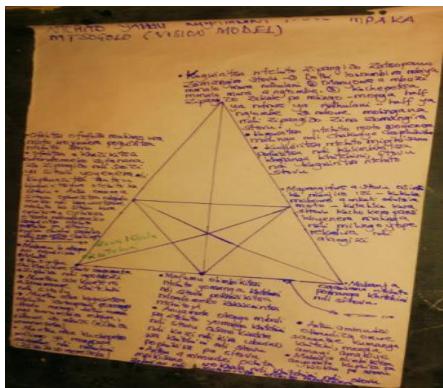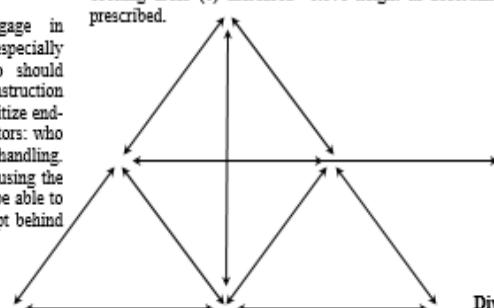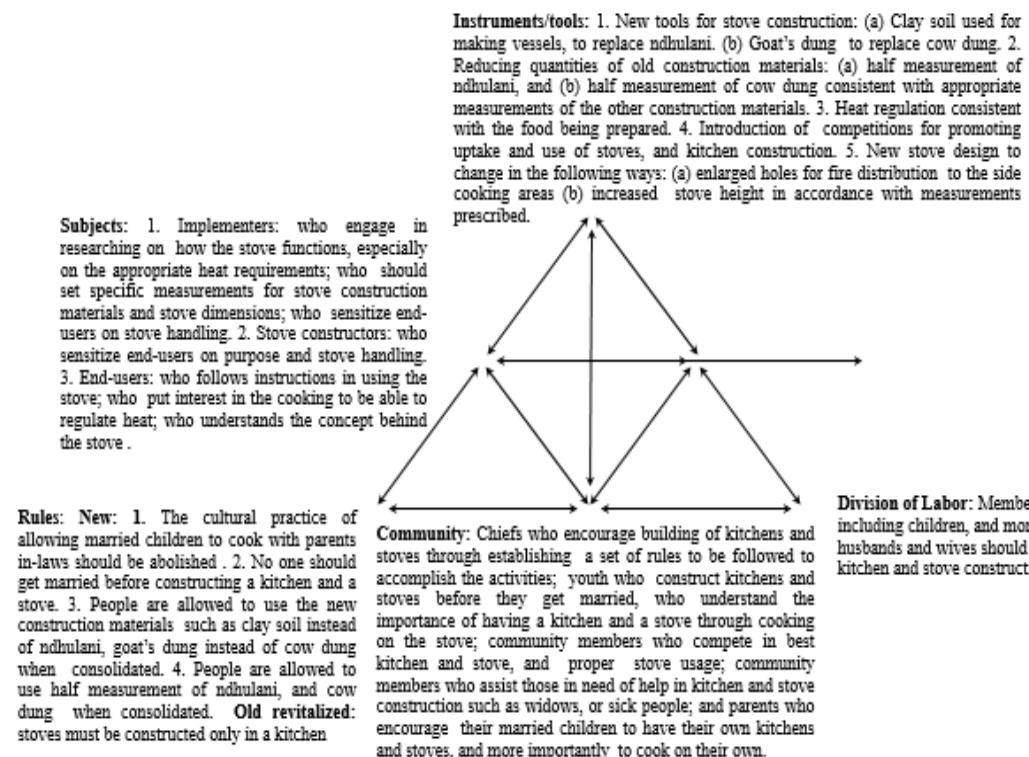
Figure 7.4: Zone of Proximal Development in ICS practice in Waziloya Makwakwa Village case study

Source: Jalasi, 2018

Participants further examined the solutions for their feasibility through finding what could support and hinder the implementation of the solutions (see Appendix 14). After examining the solutions, participants created the visionary model as depicted in Photo 7.8 and reproduced in Figure 7.5. In Photo 7.8, the space between the lists of tools was corrected as indicated in Figure 7.5.

Photo 7.8: Visionary model (Chisoni, March 2016c)

Instruments/tools: 1. New tools for stove construction: (a) Clay soil used for making vessels, to replace ndhulani. (b) Goat's dung to replace cow dung. 2. Reducing quantities of old construction materials: (a) half measurement of ndhulani, and (b) half measurement of cow dung consistent with appropriate measurements of the other construction materials. 3. Heat regulation consistent with the food being prepared. 4. Introduction of competitions for promoting uptake and use of stoves, and kitchen construction. 5. New stove design to change in the following ways: (a) enlarged holes for fire distribution to the side cooking areas (b) increased stove height in accordance with measurements prescribed.

Subjects: 1. Implementers: who engage in researching on how the stove functions, especially on the appropriate heat requirements; who should set specific measurements for stove construction materials and stove dimensions; who sensitize end-users on stove handling. 2. Stove constructors: who sensitize end-users on purpose and stove handling. 3. End-users: who follows instructions in using the stove; who put interest in the cooking to be able to regulate heat; who understands the concept behind the stove .

Rules: New: 1. The cultural practice of allowing married children to cook with parents in-laws should be abolished . 2. No one should get married before constructing a kitchen and a stove. 3. People are allowed to use the new construction materials such as clay soil instead of ndhulani, goat's dung instead of cow dung when consolidated. 4. People are allowed to use half measurement of ndhulani, and cow dung when consolidated. **Old revitalized:** stoves must be constructed only in a kitchen

Community: Chiefs who encourage building of kitchens and stoves through establishing a set of rules to be followed to accomplish the activities; youth who construct kitchens and stoves before they get married, who understand the importance of having a kitchen and a stove through cooking on the stove; community members who compete in best kitchen and stove, and proper stove usage; community members who assist those in need of help in kitchen and stove construction such as widows, or sick people; and parents who encourage their married children to have their own kitchens and stoves, and more importantly to cook on their own.

Division of Labor: Members of households, including children, and more importantly husbands and wives should be collaborating in kitchen and stove construction activities.

Figure 7.5: Visionary model of ICS activity system
Source: Adapted from Centre for Activity Theory and Developmental Work Research, 2003

7.3.5 Experimenting the new model

As indicated earlier, participants came up with eleven solutions in total, with some contradictions having more than one solution (see Table 7.7), especially because participants were not sure which of the proposed solutions was going to resolve the contradiction. This was particularly the case with experimenting on new stove construction materials and changing stove dimensions. The solutions were converted to tasks without any modifications since they were in manageable forms. Participants chose to experiment on the tasks italicised in Table 7.7 (see also Photo 7.9). Participants realised that some solutions had to be experimented before others in order to avoid duplication of efforts in conducting the

experiments. For example, using half measurement of cow dung was a solution for both addressing the scarcity of cow dung as well as reducing the heat generated by the cow dung in the stove. These were different experiments (see solutions (d) and (k) in Table 7.7) aimed at finding out whether the reduction would help solve the shortage experienced and whether it would solve the heat problem. At the same time, they were related; the former was going to be a successful experiment only if the latter was successful, since the major purpose for cow dung was heat generation and retention. However, the results were to be recorded differently. Participants had to re-examine the tasks in view of the observations and agreed to work with the elimination method. For example, if they discovered that the clay soil was producing durable stoves, they would not experiment on half measurement of *ndhulani*. Similarly, if they discovered that half measurement of cow dung was generating the heat required, they would not experiment with goat dung. They further explained that all construction materials were to remain intact, except the new material being tested during the experiments. This meant that prioritising the tasks did not limit experimentation processes; it meant that they would continue experimenting until they found workable solutions.

Photo 7.9: Tasks prioritised for experimentation (Chisoni, March 2016c)

Participants formulated task forces on each of the tasks and a cook stove committee to steer the transformative agenda. Then they came up with action plans to complete the tasks. Table 7.8 below summarises the action plans (see also Appendix 17). All the taskforces had three activities in common taking place on 25 March 2016, 1 April 2016, and 29 April 2016, which I have explained for task one only to avoid repetition.

Table 7.8: Summary of tasks for experimentation of solutions

Task description	Action
1. Construction of stove with clay soil used for moulding vessels.	To construct three stoves with clay soil ● 25 March 2016: To inform the Chief (together with all taskforces and the ICS organising committee) about the developmental work on stoves that had taken place in the previous month ● 1 April 2016: A community meeting involving the Chiefs, Village Development Committee, CADECOM project committee, all taskforces and cook stove committee ● 9, 20 and 26 April 2016: Construction of the three stoves at specific households (names withheld) ● 29 April 2016: Sensitisation meeting for community members on newly established set of rules for kitchen construction and stoves
2. Establishment of a code for construction of 'standard' kitchens and stoves	To work in collaboration with Chiefs in developing a code to guide construction of kitchens and stoves and develop a monitoring tool for monitoring if community members are following the code ● 15 April 2016: Drafting the code and the monitoring tool involving all members of the taskforce and the Chief
3. Enlarging holes inside stoves	To construct three stoves with enlarged holes measuring 10 centimetres in diameter ● 5, 12 and 20 April 2016: Construction of the three stoves at specific households (names withheld)
4. Construction of stove with half measurement (10 litres) of cow dung	To construct three stoves with 10 litres of cow dung ● 9, 20 and 26 April 2016: Construction of the three stoves at specific households (names withheld)

Source: Jalasi, 2018

After participants developed action plans, taskforces and a cook stove committee, I developed duties for the committee before I left the field. The duties are similar to those developed for the Chapita case study. (See Section 7.2.5.1 and Appendix 17.)

7.3.6. Reflection and consolidation of the new practice

In Waziloya Makwakwa, reflection and consolidation of the new form of activity took place about three months after the last session of the BCCLW. I will start with reporting on the progress of the tasks, before explaining how research participants carried out the actions of reflection and consolidation. Then I will report on further development that had taken place after consolidation of the new form of practice.

Participants started experimenting on the solutions a few weeks after the last session of BCCLW. In May 2016 I received a progress report from the Field Facilitator on the tasks (see Appendix 19). In the report, I noted participants had experimented on more tasks than the ones prioritised.

7.3.6.1 Progress on the tasks

Ten stoves were constructed in total for tasks 1, 3 and 4. However, there was confusion in that the experimentation combined several variables in one instead of conducting three different experiments with each testing a variable. The outcome of the combined experiments on stove construction were four types of stoves as depicted in Table 7.9. (see also Photo 7.10).

Table 7.9: Stove constructed for experimentation

Stove 1	Stove 2	Stove 3	Stove 4
1. Half measurement cow dung (10-litre bucket) 2. 20-litre bucket clay soil for moulding vessels 3. Enlarged holes (about 10 centimetres diameter)	1. Full measurement cow dung (20-litre bucket) 2. 20-litre bucket clay soil for moulding vessels 3. Enlarged holes (about 10 centimetres diameter)	1. Full measurement cow dung (20-litre bucket) 2. Full measurement *ndhulani* 3. Enlarged holes (about 10 centimetres diameter).	1. 20-litre bucket goat's dung 2. 20-litre bucket clay soil for moulding vessels 3. Enlarged holes (about 10 centimetres diameter)

Source: Jalasi, 2018

Participants explained that the confusion happened because they worked as one group, instead of working in separate taskforces as agreed during the development of action plans; in the process, they did not follow / forgot the instructions. As a result, it was difficult to understand how the stove would perform in the presence of each of the variables which we wanted to test. The Field Facilitator made the following observation on one of the experiments:

> **Participant AK:** *We have made a mistake because we needed to reduce cow dung, our objective was to see how the stove would perform with full measurement of* ndhulani*, but with reduced cow dung, so the question is how we differentiate the performance because we combined clay soil and half measurement cow dung.* (FUW MZ1)

Nevertheless, participants were able to report and comment on the outcome of the experimentation in relation to what we planned to experiment. They indicated that the stoves, which they constructed, were performing very well in terms of durability and heat retention and that they provided solutions to the contradictions identified. The excerpts below provide evidence:

> **Participant MN:** *I have the one with half cow dung and 20 litres clay soil, but it is performing well, the whole stove is hot.* (FUW MZ1)

> **Researcher:** *What about scorching of pots? Because the problem we wanted to resolve with this stove was scorching of pots.*

> **Participant MN:** *No, it is not scorching pots.* (FUW MZ1)

> **Researcher:** *What about stove 2?*

> **Participants:** *They are performing the same way.* (FUW MZ1)

> **Researcher:** *How is it performing?*

> **Participant FN**: *It is also hot.* (FUW MZ1)

> **Researcher:** *What about scorching of pots?*

> **Participants:** *No.* (FUW MZ1)

> **Researcher:** *Is it not scorching pots?*

Participants: No, it is not. (FUW MZ1)

Participants DM & EC: The owners said it does not. (FUW MZ1)

Participant MP: Now that they enlarged the holes, the stoves are not scorching pots anymore. (FUW MZ1)

Researcher: So you also enlarged holes on the same stoves.

Participants: All the stoves have enlarged holes. (FUW MZ1)

Researcher: Now the problem is that we don't grasp what experiments we conducted because all the variables are combined in one.

Participant DM: People were refusing to have stoves with small holes inside. (FUW MZ1)

Participant CB: The thing is people already know how the stove with small holes performs, so because we already have the knowledge, we wanted to experiment now with enlarged holes, and see how it performs. So we compared the old stoves with small holes and the new ones with enlarged holes we see that they are different. That's how we know. (FUW MZ1)

Researcher: This will have implications for consolidation of the new practice because we cannot tell whether the reduced measurement of cow dung or the enlarged holes is responsible for resolving the problem of scorching pots.

Participant RS: Those of us who had the old type of stove complain about scorching of pots. But when we went for follow up to get results, those with new stove types with enlarged holes and all the different materials said their stoves are not scorching pots and the stove retains heat until at night. (FUW MZ1)

Participant DM: The whole night. (FUW MZ1)

Participant RS: … that means the way we constructed, the old… (BCCLW MZ 1)

Participant MN: …The old stoves. (FUW MZ1)

Participant RS: … stoves have problems, the new stoves have no problems, and we will continue with the new stoves. We will do away with the old stoves. The new fashion will be those with enlarged holes, whether it uses ndhulani, or clay soil for making vessels, but the holes should be bigger. (FUW MZ1)

Researcher: … I am a bit confused in how we consolidate the new model because we can't separate the variables, because we can't conclusively say enlarging holes on their own will prevent scorching pots …

Participant EC: I constructed a stove with full pail of ndhulani, and full pail of cow dung (Stove 3) and enlarged holes, and it is performing very well. (FUW MZ1)

Researcher: … How about the performance of this one with goat's dung?

Participants: It is performing very well and it retains heat. (FUW MZ1)

After a long deliberation, participants resolved the confusion and provided evidence that all the stoves were functioning properly, and most importantly, they resolved the contradictions related to the scarcity of *ndhulani*, cow dung and scorching of pots. They were also confident that the results they obtained could be used to come up with new rules and tools in the new form of activity. In essence, Stove 3 was

the correct experiment for task 3 and the one that guaranteed the researcher interventionist that enlarging holes reduced too much heat in the middle cooking area, hence addressing the problem of scorching of pots. This is because the enlarged holes was the only new variable when compared to the old type of stove.

During the discussion, participants pointed out that despite the confusion, they had decided to use clay soil for experimentation for most stoves, because *ndhulani* was scarce. Hence, to find it for experimentation was difficult. This shows the evolution of research participants' agency in going beyond the planned actions and seeking for alternative ways of working.

Photo 7.10: New stoves constructed with new materials, measurements, and dimensions (Chisoni, June 2016b)

Apart from completing tasks concerning construction of stoves, participants were supposed to work with the Chief in developing a code to guide construction of kitchens and stoves and develop a monitoring tool for monitoring if community members were following the code.

Participants had a meeting with the Group Village Headman (GVH) as planned. The GVH received the message positively and expressed the importance of changing the traditions that impinge on developmental work as evidenced in the excerpts below as reported by a member of the taskforce:

> **Participant CB:** *What you are explaining here is very important and necessary. Many young men these days fail even to garden because they rely on their mother, and feel no need because they know they will be living with their mother. They do not want to be independent and know how to take care of themselves. Let's collaborate, this is a very good research project. I will call all Chiefs and explain to them.* (FUW MZ1)

The GVH organised a meeting with all the Village Headmen a few days after meeting the members of the taskforce. During the meeting, he explained the new development. However, they did not develop the code as planned. Instead, the GVH commanded the Village Headmen to encourage community members in their various villages to construct kitchens and stoves as evidenced from the excerpt below reported by the leader of the taskforce:

>*Participant DM: I, in my powers as GVH Waziloya Makwakwa command that everybody before they get married, or if they are already married, as long as they are in my village, should construct kitchens. I need kitchens in my village.* (FUW MZ1)

The leader of the taskforce also consulted the Health Surveillance Assistant (HSA) to take part in encouraging community members, since part of his duties was to work with the community on issues of health and sanitation. However, there was limited progress on the task. Only one new kitchen was constructed during the entire experimentation process (see Photo 7.11). Participants expressed two major reasons for the little progress made. First, that resolving the contradiction was concerned with changing a deep-seated cultural practice, therefore it was going to be a slow process. However, some people had started working on their kitchens.

>*Participant MN: This task just started … Some people have started moving out of their mother in-laws to be on their own. Some have started constructing kitchens. But it will continue slowly. A newly introduced way of doing things [cultural] usually starts slowly. Also, they [community members] have not grasped its importance, when they will do, I am sure this process will continue.* (FUW MZ1)

>*Participant CB: … to change a cultural practice takes a long time since all this past, married couples have been living with their parent in-laws, and the mother in-law was taking care of everything. There are even times when the daughter in-law has no wrapper, and the mother in-law has to buy, a blanket should come from the father in law…* (FUW MZ1)

The second reason was attributed to the fact that the Health Surveillance Assistant (HSA) had no kitchen. Members of the community were supposed to construct a kitchen for the HSA, but they had not. The HSA is responsible in promoting construction of health and sanitation facilities in the community, such as kitchens, pit latrines, rubbish pits, hanging lines, plate racks, and low-tech hand washing facilities. Since he had no kitchen, some members of the community found it contradictory when he encouraged them to construct a kitchen, as evidenced from the excerpt below:

>*Participant CB: The problem is that the HSA has no kitchen, and therefore people cannot make sense of the need for a kitchen especially when the HSA is responsible for its promotion. People cannot understand. How can you tell someone to sweep at her house when you have not swept at your house? You start sweeping at your house.* (FUW MZ1)

>*Participant AK: … do you want to tell me that people can fail to construct a kitchen because the HSA has no kitchen?* (FUW MZ1)

>*Participant DM: Yes, some people talk like that. That side where I stay some people talk like that …* (FUW MZ1)

>*Participant DC: … Yes, what DM is saying is true, close to where I stay I overheard someone saying, why is Mr B (HSA) busy telling me to dig a pit latrine, why can't he come to dig it for me, I can't dig a pit latrine …* (FUW MZ1)

Photo 7.11: Newly constructed kitchen (Chisoni, June 2016b)

The failure to construct kitchens was not the only sanitation problem in the village. There was a 'deep-seated cultural malaise' that most people had no latrines. When I first visited the project site in 2014, a woman greeted me and confessed that CADECOM project helped her a lot because she was using a latrine for the first time in her life. This implies that there is need for more learning, in order to facilitate uptake and use of the stoves, since the stove type requires a kitchen as discussed earlier (see Chapter 6, Section 6.4.1.1).

7.3.6.2 Further development after consolidation of new form of practice

In order to continue tracking how research participants' agency unfolded towards the transformation of the activity, I conducted a follow-up dialogue (see Chapter 3, Section 3.7.7) with one of the participants of the BCCLW, who is also the chairlady of the CADECOM project in the study site. My plan was to talk to several research participants, however, I did not manage to get through on their cell phones. The Field Facilitators had also left because the project had phased out on 30 June 2016, a few days after the last day of the follow-up workshops. When I called him, he suggested I talk to the research participants on the ground. Box 7.2 provides a summary of the developments that took place in the community after consolidation of the new form of activity.

Box 7.2: Expansive developments after consolidation of the new form of practice

1. Enhanced collaboration with Health Surveillance Assistant.
2. Chiefs are taking part in the stove project.
3. Two community sensitisation meetings were held in the project site.
4. Seven kitchens constructed.
5. Approximately 27 ICS constructed after consolidation of new practice, within the project area Ehlonipeni and Kapongolo, and outside the project area at Ezweleni and in GVH Kamudambo Kamwaka.
6. Two sensitisation meetings were held at GVH Saston Nguluwe and GVH Kawanika Chisi. Some BCCLW participants sensitised the communities about the relationship between climate change, deforestation, and ICS. Of the fourteen women who attended the meeting at GVH Saston Nguluwe, five women requested construction of stoves. At GVH Kawanika Chisi, eleven women attended the meeting.
7. The construction group had started charging for stove construction outside the project area, to raise money for group activities. This followed the agreement reached on the last day of follow-up workshops as indicated earlier (see Section 7.3.3). Participants had agreed that members of the construction group can charge for stove construction outside the project area only, but within the project area it was free. They also agreed that the price should not be too high for affordability purposes. They were yet to develop a plan on how this was to be executed. During the follow up dialogue, it was clear that they had developed a plan and started using it.

Source: Jalasi, 2018

The developments as described in Box 7.2 indicate how interaction was expanded among other activity systems beyond the network of the interacting activity systems that I worked with at the beginning of the study. There was enhanced collaboration with the HSA; in addition, the Chiefs became more proactive than during the CADECOM project. Further, the developments that had taken place after consolidation processes in the case study resonate with earlier observations (see Section 7.2.6.2) that expansive transitions take a long time (Sannino et al., 2016) and require lengthy follow-up periods in order to track the sustainability of ideas and actions taken (Haapasaari et al., 2016, p. 258). The developments also show how communities took the initiatives to transform their activities in the absence of Field Facilitators and the researcher interventionist. More important is the fact that, through the joint activity and given newly developed tools, research participants became more capable of achieving much more. This underscores the concept of ZPD as conceptualised by Vygotsky (1978).

With the phasing out of the CADECOM project a few days after the last day of follow-up workshops, all participants of the BCCLW took over the role of the implementers. They felt empowered through the learning processes and coupled with the newly designed tools and rules, they started sensitising other communities, promoting stoves and training others on how to construct stoves (see Box 7.2).

7.3.6.3 Reflection on the learning process

Before consolidating the new form of practice, participants reflected on a number of issues (see Appendix 15). However, in this section I include reflections that relate to the research question addressed in this chapter and the overall goal of the intervention, which is transformative praxis. I will also focus on the main issues on each of the topics discussed in summary form using participants' own voices as shown in Table 7.10. The remaining topics are discussed in Chapter 8, Section 8.2.2. After reflection, participants

reviewed the reflections in preparation for consolidation of the new practice. Table 7.10 provides a summary of participants' reflections on the learning process.

Table 7.10: Participants' reflection on the expansive learning process

	Participants' reflections on the expansive learning process
How and what participants learnt	We accepted the stoves with their problems and thinking that things are supposed to be that way, we never questioned, but now we know how to question and understand the problems
	Learning is important
	It is possible to find solutions to our problems through research, through working because we have the materials, we have searched and experimented
	Discussion, experimentation, and examining how things work make understanding things much better
	Working with locally available materials to find solutions to our problems has helped us to progress in our activity
Things that supported the learning process	The questions that you were asking and our answering, and having the opportunity to ask questions helped us to learn better
	Meeting at a convenient place away from home
	Experimentation with things helped us to understand better
	There was good interaction
	Meeting closely at these meetings helped us not to forget issues
	We were free with each other
Things that hindered the learning process	Some people were failing to ask questions; maybe it was out of fear or shyness
	Failing to understand issues, maybe because of communication barrier
	We were taking long time in class
Possibilities clearly seen in the implementation of the new model	It is possible for people to develop the agency to work on stove activities when they are encouraged
	It is possible to work with the Chiefs because they received the message positively and they took some initiatives
Problems clearly seen in the implementation of the new model	That it takes longer to change a cultural practice and that if there is no strong encouragement and reinforcement, people cannot construct kitchens
	Community members have not yet grasped the importance of a kitchen
Resources identified for the implementation of the new form of activity	Need for collaboration between the Chiefs and Health Surveillance Assistant (HSA) because the HSA cannot manage to facilitate change in people's ways of living alone
	Group Village Headman (GVH) should encourage Village Headmen on stove activities
	Cook stove committee should work with GVH, but also with Village Headmen directly
	Strengthening the by-laws at the Traditional Authority level on health and sanitation through Area Development Committee (ADC) and Village Development Committee (VDC)
	Sensitising and facilitating learning processes to community members frequently
	Other existing project committees, clubs, and volunteers
	Chair of the Village Development Committee
	Participants of the BCCLW should be role models
	Going on the radio to share and spread the learning processes and the stove developmental work
	Participant DM as an influential person in the community to work specifically on promotion of kitchen construction
	Schoolteachers to take part in explaining the information about stoves to schoolchildren

Source: Jalasi, 2018

7.3.6.4 Consolidation of the new model of activity

After research participants reflected on the learning process and reviewed the reflections, they consolidated the new form of practice as depicted in Table 7.11. They also developed a five-year

roadmap as a substantiation of the expansive learning process (see Appendix 18, Waziloya Makwakwa Village case study). Two issues need to be highlighted in the roadmap document:

(a) The roadmap was the means for spreading the new practice to others who did not take part in expansive learning processes within and outside the project area.

(b) The establishment of the cook stove committee as a permanent committee among committees that CADECOM established in the study site to take care of different components of the Integrated Community Development project and as a committee under the Village Development Committee.

Table 7.11: New form of practice

Elements of activity System	Old Principle	New Principle
Tools/ instruments	1. We were using *ndhulani* in stove construction to make the stove durable. 2. We were using one 20-litre pail of cow dung to generate and retain heat in the stove. 3. We were using cow dung only to generate and retain heat in the stove. 4. We were using small size piece of banana trunk to make holes inside the stove for distribution of fire to the side cooking areas. 5. There were no by-laws specific for kitchen construction. 6. We had no cook stove committee in the village .	1. We will be using clay soil used for moulding vessels instead of *ndhulani*. In addition, we will be using *ndhulani* if it is available. 2. We will be using 10-litre pail of cow dung to generate and retain appropriate amount of heat. 3. We will be using goat dung instead of cow dung to generate and retain heat in the stove. In addition, we will be using cow dung if available as in 2 above. 4. We will be using a little bigger size of banana trunk (about 10 cm diameter) to make holes inside the stove for distribution of fire to the side cooking areas. 5. By-laws for reinforcement of kitchen construction should be developed and be followed. 6. We have a cook stove committee in the village.
Subjects	7. *Implementers* did not research appropriate heat required when using the stove. 8. *Implementers* did not establish proper stove measurements and dimensions. 9. *Implementers* were not sensitising end-users on stove handling. 10. Stove constructors were not sensitising end-users on stove handling, purpose, and importance of stoves. 11. End-users were not following rules when using the stove.	7. Implementers need to research on the appropriate heat required for the stove. 8. *Implementers* should establish proper stove measurements and dimensions. 9. Implementers should be sensitising end-users on stove handling. 10. Stove constructors should be sensitising end-users on stove handling, purpose, and importance of stoves. 11. End-users should be following rules; when they have a newly constructed stove, they should wait for the stove to dry completely and should follow instructions on stove handling.
Object	12. Promotion, construction and cooking on a stove with small holes inside 13. Promotion and construction of stoves with different dimensions especially height	12. Promotion, construction, and cooking on stoves with enlarged holes inside 13. Promotion and construction of stoves with similar dimensions especially height

Rules	16. A stove should be constructed in a kitchen.	14. Married couples should not cook in their mother-in-law's kitchens, but in their own.
		15. Nobody should get married before constructing a kitchen and a stove.
		16. A stove should be constructed in a well-thatched brick or cob kitchen.
Community		17. Chiefs should take the lead in encouraging community members to construct kitchens and stoves in the village.
		18. Young men and women should take part in kitchen and stove construction.
		19. Families should encourage young men and women to be independent (cook on their own) and construct a stove.
Division of labour	20. Most families were not dividing roles in kitchen and stove construction.	20. Family members should divide roles and responsibilities in kitchen and stove construction.

Source: Jalasi, 2018

7.3.6.5 Germ cell generation

In the Waziloya Makwakwa case study, the germ cell was the old motto that research participants chanted several times in various sessions. The motto was *'reenergised'* through the formative interventionist idea of 'designing of locally appropriate new solutions' (see Chapter 3, Section 3.5.1). In essence, it was the simple idea that I did not bring any external materials or foreign ideas, but worked with participants with what they had in their context. In turn, it *'energised'* the learning process, and became the catalyst for the experimentation processes; in the process, it *'reenergised'* research participant's agency to transform their activity. It first appeared during the planning meeting as part of a comment from one Field Facilitator. From my side, I never realised that this idea was going to be a catalyst for the transformation processes in the joint activity.

> **Participant FC:** *… this approach can help us in many different developmental projects … sometimes in our communities we wait for others to bring us development, but if we can use these approaches it will help us to **develop our lives on our own** and fill in the gaps.* (PM MZ1)

The second time research participants chanted the motto as an appreciation for the researcher interventionist for keeping time. From that point, they chanted the motto several times in different sessions. Some participants used it in recognising and emphasising the importance of using locally available resources for resolving problems encountered. In some instances, it was used as a form of reflexivity and agency, placing the responsibility of transforming our activities on 'ourselves' using locally available resources and solutions. The following are some of the examples:

> **Participant DC:** *On this activity what I have learnt … the problems we used to face are over, with clay soil the problem is addressed, and with goat's dung that problem is over. We now know that we will perform our activities on our own, because we have all [the materials] at home.* (FUW MZ1)

Participants CB: This implies that the problems we had, have been reduced because we have the materials, and we have the people to perform the activity in our village. What we lacked was just the knowledge … (FUW MZ1)

Participant MN: Everything has progressed well because this research has helped us to know how to use the things that we have, whether it is the skills, knowledge, or how to think. This has helped us to understand that we can use this approach in various other developmental activities not only on stoves. (FUW MZ2)

The Field Facilitator also echoed this in the following comments:

Participant FC: The second thing is that this research, this learning process has helped us a lot because the approach is similar to the one CADECOM uses the Strength Based Approach, which emphasises that people should use the skills and materials they have. The approach for this research also encourages people to use the very same materials they have in their environment. This has energised the participants knowing that, what CADECOM told them and what this research approach emphasises is the same, that developmental work activities belong to us and how we act. (FUW MZ2)

Participant FC: … the learning process has helped us to understand that we should not lose hope when we encounter any problems, but we should find an alternative way of doing it especially by using the things that we already have, the first thing is to believe in ourselves. You see at first we thought Chisoni [researcher]… will bring us something new from outside, we thought may be instead of ndhulani *she will bring us some soil from elsewhere but we have seen that everything is found here, we just lacked the approach to experiment on the things …* (FUCS MZ1)

This was the last comment of the follow-up workshops and after that, the participants recited the motto (see Box 7.3), which as indicated earlier was the germ cell.

Box 7.3: The motto as a germ cell

Chitumbuka original version: "*Tingamanya kutukula umoyo withu pa ise tekha pakugwiriska ntchito zipangizo izo tili nazo!*"

English equivalent: "We can develop our own lives by using the materials that we have in our local environments!"

Source: Jalasi, 2018

7.3.7 Summary

Expansive learning processes in the Waziloya Makwakwa case study expanded learning interactions among other activity systems beyond the network of the interacting activity systems that I worked with at the beginning of the study. There was enhanced collaboration with the HSA; in addition, the Chiefs became more proactive than during the CADECOM project. Evidence indicates that Chiefs learnt something through *committing to concrete actions* and *taking consequential actions* to change some aspects of the activity. In Chapter 5, I presented the existing learning interactions before expansive learning processes (see Figure 5.20). The learning interactions were expanded after carrying out expansive learning processes. It is important to highlight that the learning included members of the community who did not take part in the BCCLW, as well as those outside the case study site (see Box 7.2). Figure 7.6 depicts expanded learning interactions. It identifies the learning subjects and the nature

of interaction. The arrows identify the learning subject in each interaction. The connected cycles within the triangles indicate learning interaction between subjects of an activity system. While in Figure 5.20, no learning interaction occurred between end-user and stove constructor, in Figure 7.6 they are learning from each other. Notice also the shift in directionality of learning interaction from unidirectionality in Figure 5.20 to bi-directionality in Figure 7.6.
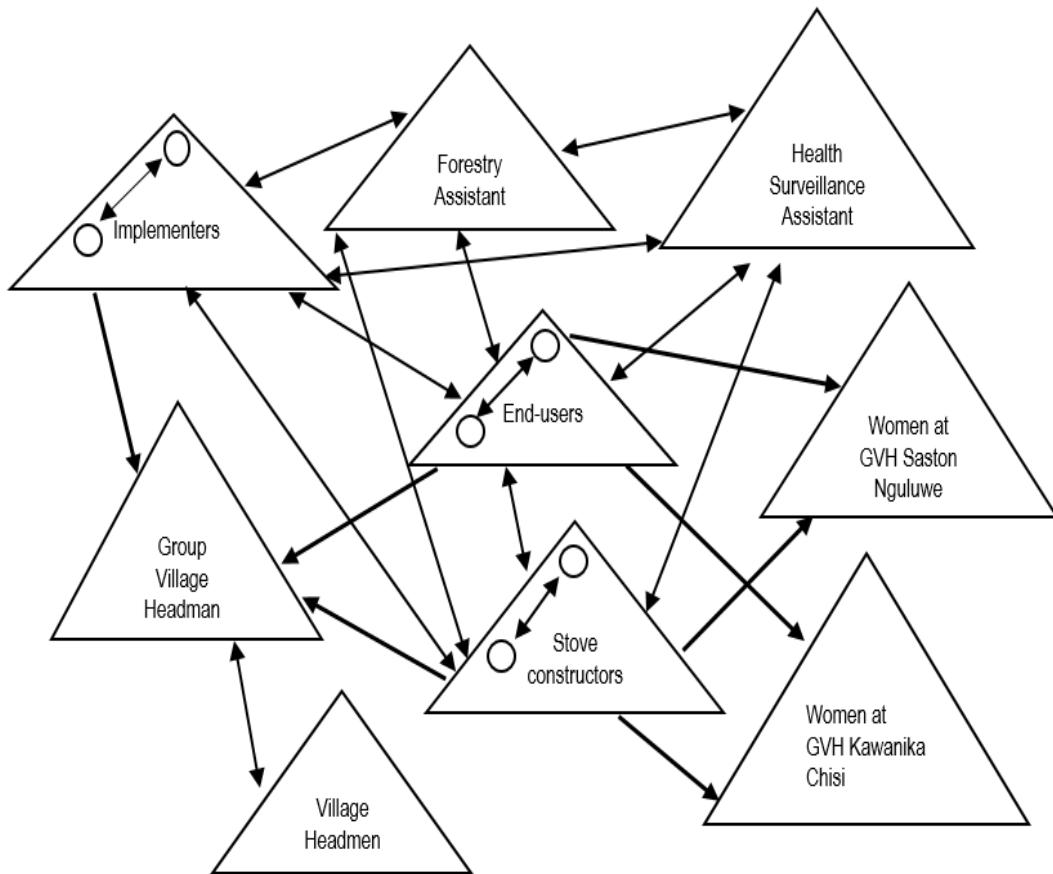
Figure 7.6: Expanded Learning interactions in Waziloya Makwakwa Village case study
Source: Jalasi, 2018

Evidence also shows that participants' agency was evoked, and reflexivity enhanced through expansive learning processes. This will be discussed in Chapter 8. During the deliberations, it was also possible to see how participants were moving towards collaboration in their work. In the next chapter, Chapter 8, I will discuss how this took place.

As indicated in Chapter 4, contradictions in this case study revolved around uptake of ICS, which had impact on utilisation. Within uptake, most problematic situations concerned tools. Through expansive learning processes, participants were able to come up with new tools from their local contexts to resolve the contradictions. Identification of the new tools had generative potential for the new form of practice.

However, some contradictions needed more learning and time to resolve, for example, the contradictions related to the lack of kitchens in the community, as it concerns deep-seated cultural practice.

Worth noting is that participants owned the learning process, as evidenced from how they decided to experiment with clay soil instead of *ndhulani,* going against the planned experiments. Hence, my role as a researcher interventionist was to steer up the expansive transformation. Evidence from this case study therefore indicates that Developmental Work Research, using BCCLW as a tool kit in the implementation of formative interventions, can be used successfully as an approach to dissemination of socio-technical innovations. Participants reconceptualised the object of their activity with deeper meaning attached: that problems are inherent in the activity; that it is not static but evolving; and that new ways of doing things can unlock potential in the activity (see Sections 7.3.6.3.1 and 7.3.6.5).

7.4 Conclusion

This chapter has discussed how learning interactions were expanded among activity systems in two case studies through expansive learning processes, aided by BCCLW. BCCLW provided a space where practitioners and the researcher interventionist deliberated on problematic situations identified in the ICS practice, modelled solutions, experimented on the solutions, and used the experimentation to consolidate a new form of ICS practice. Expansive learning processes enhanced agency and reflexivity in research participants in ways that I as a researcher interventionist never anticipated. In Chapter 8, I will discuss how participants' reflexivity was enhanced and their agency evolved to transform the ICS practice through the learning processes. In addition, in Chapter 8 I will discuss the mode of interaction among research participants during BCCLW.

The discussion in this chapter has shown that Developmental Work Research and BCCLW toolkit can be used successfully to enhance interaction, reflexivity, and agency among actors working in ICS practice in Malawi, which are crucial in influencing sustained uptake and utilisation of ICS. At the same time, the chapter has provided evidence that conducting BCCLW has its own limitations (see Section 7.2.6.1-7.2.6.2; 7.3.6.1 and Chapter 3, Section 3.7.5.1 and 3.10.4). For example, in Chapita Village case study, the absence of implementer and policy activity systems may have contributed in a negative way to the progress of some Transformative Agency Pathways (see Chapter 9, Section 9.3.3). I would like to argue here that, the absence of one activity system during BCCLWs might jeopardise transformative processes, of an otherwise successful expansive learning process. In this regard, research interventionist planning to conduct BCCLWs needs to devise plans and allocate time ahead of BCCLWs, which participants can use to deal with situations, such as the one I encountered in the Chapita case study. In Waziloya Village case study, the main limitations encountered during BCCLW was the pre-emptive Field Facilitator (see

Chapter 3, Section 3.10.4) and the problematic situations encountered due to decisions participants made to work as one group, contrary to the action plans developed during BCCLW (see Section 7.3.6.1).

CHAPTER 8: INTENSIVE ANALYSIS OF EXPANSIVE LEARNING PROCESSES – MAPPING TRANSFORMATIVE AGENCY PATHWAYS

Environmental and sustainability education processes are often oriented to change and transformation, and frequently involve the emergence of new forms of human activity. However, not much is known about how *such change emerges from the learning processes or how it contributes to the development of transformative agency in community contexts.* (Lotz-Sisitka, Mukute, Chikunda, Baloi & Pesanayi, 2017, p. 897).

8.1 Introduction

This chapter answers question 4 as indicated in Chapter 7; it continues and concludes the discussion from Chapter 7. In Chapter 7, I discussed how I worked with participants in the Chapita and Waziloya Makwakwa case studies to analyse conflicts and disturbances in their activities and searched for ways to transform their current practices. I illustrated how learning interactions were expanded among interacting activity systems and how participants had learnt from the expansive learning processes. This chapter shows details of *how* change emerges from expansive learning processes through the development of transformative agency and helps to address the concern raised by Lotz-Sisitka et al. (2017) as quoted above. The chapter draws from Sannino's Vygotskian double stimulation model (Sannino, 2015a) to show Transformative Agency Pathways (TAPs) in which I demonstrate the power of reflective talk and expressions of transformative agency in the transformation of ICS practice. In applying the model, my intention was to demonstrate how reflective talk and expressions of transformative agency lead to decision forming and decision implementation. In some cases, participants' transformative agency was expressed through actions; this will be demonstrated where applicable. I will also demonstrate how individual agency led to collective agency, through tracking research participants' expressions of transformative agency. Collective agency energises decision forming and decision implementation processes. Individual expressions of transformative agency "require collaboration and collective agency to survive and expand" (Haapasaari et al., 2016, p. 258). Further, I will demonstrate how participants' orientation shifted towards other members from other activity systems or within an activity system, which will demonstrate the dynamics of collaboration in their work using three modes interaction as indicated in Chapter 3, Section 3.8.3.1. This integrated analysis seeks to pull some theoretical concepts together and show how they relate to each other.

8.2 Transformative Agency Pathways and Sannino's Vygotskian double stimulation model

The TAPs draw from Sannino's Vygotskian double stimulation model. Sannino (2015a) described the Vygotskian double stimulation model as involving two apparatuses. The apparatuses describe the emergence of will, "are relatively independent of each other" and depict two stages in the evolution of will (Vygotsky, as cited in Sannino, 2015a, p. 9). "Apparatus 1 consists of the formation of the decision to act in a certain way by means of auxiliary motive" (ibid., p. 9). People form a decision by creating for themselves an instruction of how to act (ibid.). Auxiliary motive comprises thoughts such as "when this happens I will perform this action". Sannino provided 'the fall of a die' as an example. On the other hand, apparatus 2 consists of the implementation of the decision formed in apparatus 1. Apparatus 1 involves four phases as depicted in Table 8.1. It is triggered by a clash between stimuli and hence phase 1 of the apparatus is *conflict of stimuli*. In such a situation, the person is "at the mercy of the environment" (Vygotsky, in Sannino 2015a, pp. 9-10). Phase 2 consists of *conflict of motives.* According to Sannino (2015a, p.10), "the conflict of stimuli in phase 1 activates motives, involves them in the conflict of stimuli and turns the conflict of stimuli into a conflict of motives". "These two motives alternate, appear in consciousness, and replace each other" (ibid., p.10). Motives are important because they "play a key role in the formation of voluntary actions" and conflict of motives are central in the formation of wilful actions (ibid.). At such a stage, the person is at the mercy of motives (ibid.). In Phase 3 the functional role of a stimulus changes and converts into an auxiliary motive (Vygotsky in Sannino, 2015b, p.10). According to Sannino, this stage is most important. This is because the person uses the power of things or stimuli to control their behaviour or rather to make a decision (Sannino, 2015b). However, at this stage the person does not know exactly how they would act with the introduced stimulus remaining neutral. "Phase 4 starts with the moment of direct, unmediated appearance of the neutral stimulus", when the direct stimulus occurs the person is confronted with "a signal and a connection with it" (Vygotsky, in Sannino, 2015a, p. 11). This phase is depicted as 4a in Table 8.1. "In the waiting experiment, the signal is the hand of the clock turning to the given time and the connection is the decision to act in a certain way" (Sannino, 2015a, p.11). This stage is critical "in the formation of the voluntary action" (ibid.). This is because the real or actual stimuli takes place (Vygotsky, in Sannino, 2015a, p. 11). Phase 4b is the closure of the connection between the given stimulus and the reaction (ibid.). (See Figure 8.1 below.)

Table 8.1: Sannino's (2015a) Vygotskian model of double stimulation

Phase	Detail	Example from waiting experiment
Apparatus 1: Decision forming	*Comprises phases outlined below: at issue is the choice of closure path*	
1-Conflict of stimuli	Demands or expectations that pull in opposite directions	Being asked to stay vs. having no purpose in empty room
2-Conflict of motives	Activated by conflict of stimuli, subject at the mercy of motives	Conforming to instruction to wait vs. wanting to leave
3-Auxiliary motive	Conversion of stimulus to auxiliary motive, subject begins to control her behaviour	Deciding to use clock to make decision
4a- 'Real' conflict of stimuli	Occurrence of neutral stimulus confronting subject with signal and meaningful connection	Clock reaches particular time
4b-Closure of conditioned connection	Decision to act in particular way, subject makes decision based on occurrence of external stimulus	Participant decides to leave the experiment
Apparatus 2: Decision implementing	Activation of the conditioned connection	Participant leaves the experiment

Source: Hopwood and Gottschalk, 2017, p. 24

In applying the model "in the wild"[35] to analyse professional practice in parenting services for parents with children at risk, Hopwood and Gottschalk (2017) found that "while the model offers conceptual clarity, determining the manifestation of its features in empirical data was not straightforward" (p. 26). They also found that "in some instances the pertinence of motive, and especially an understanding of conflict of motives, was not apparent from reading data proximal to the use of a potentially auxiliary tool" (pp. 26-27). They had to infer meaning from other parts of the same transcript, or other transcripts altogether (ibid.). This is similar to the data I generated during BCCLWs. The manifestation of the conceptual features in some transformative pathways is not straightforward. In most cases, the stages did not appear chronologically. This is because in real-life situations, the distance between auxiliary motive and real conflict are far apart, especially in the use of the expansive learning cycle, since questioning and experimentation with solutions occur far apart because the expansive learning process is iterative (Mukute, 2010). Similarly, Sannino and Laitenen (2015), in the experiment they conducted to test the Vygotskian double stimulation model, found that some stages, especially phase 4a and 4b were not observable in some cases and their occurrence was inferred. In this study, it also was not possible to capture empirical evidence of phase 4 because it may have occurred during experimentation stage when I was not in the field with participants except for the Chapita case study TAP 1. Nevertheless, in the discussion of the TAPs below, stages 4a and 4b are inferred, where possible evidence is provided as reported by participants.

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[35] These are contexts where there is no research intervention or experimental set-up. They are also referred to as "everyday work" (Hopwood & Gottschalk, 2017, p. 23).

Using data generated in the BCCLWs, I applied aspects of the model to demonstrate how reflective talk and expressions of transformative agency and actions and interaction among participants led to decision formation and decision implementation. The discussion draws from Chapter 1, Chapter 2 and Chapter 6 in which I provided evidence of conflict of stimuli and conflict of motives. In the discussion of contradictions in Chapter 6, one is able to trace the demands or expectations within the ICS practice pulling in opposite directions and conflict of motives facing subjects of activity systems. The introduction of the socio-technical innovation in the traditional cooking practice, vis-a-vis the demands arising from protecting the environment, women and children's health give rise to four general conflict of stimuli within the subjects of interacting activity systems:

1. Socio-cultural practices vs. socio-economic situation
2. Socio-cultural practices vs. environmental and health concerns
3. Socio-economic situation vs. environmental and health concerns
4. Top-down models and assumptions around socio-technical innovation implementation and adoption vs. environmental-health concerns

These appear general but are specified in Chapter 6's discussion of contradictions and reporting of data in Chapters 1, 2, 4, 5, 6 and 7 of this study and in this chapter.

Each pathway corresponds to either one, two or all the general conflict of stimuli, plus a specific more contextually expressed conflict of stimuli. Both levels of stimuli activate conflict of motives. The conflict of motives arise when subjects of activity systems respond to the introduction and requirements of the socio-technical innovation, vis-a-vis, promotion, production, and use. The socio-technical innovation can also be seen as an external stimulus to the socio-cultural-economic-environmental situations that actors found themselves in, as explained in Chapters 1, 2, 4, 5, 6 and 7.

The TAPs outlined in this chapter show how the participants of the BCCLWs converted the stimuli to control their behaviour or to get out of the conflicting situations by the use of auxiliary stimuli offered in the BCCLWs. The participants were offered conflicting motives, discussed in Chapter 6 as part of the first stimuli. The triangular model and different tools were used as a second stimuli and helped them reorganize their activity systems, stimulate thinking and reflexivity reported in Chapter 7. Taking control of one's own behaviour is "a mediated process that is always accomplished through certain stimuli" (Vygotsky, 1960/1997 as cited in Hopwood and Gottschalk, 2017, pp. 24 -25; quote emphasis in Hopwood & Gottschalk). Stimuli operating in this auxiliary capacity are also referred to as second stimuli; they occur more than once (Hopwood & Gottschalk 2017, p. 25). Participants of the BCCLWs introduced different sets of second stimuli for each of the conflict of motives.

The analysis discusses only selected TAPs in detail (see Chapter 3, Section 3.8.3.1 for an explanation) to demonstrate how Expansive Learning triggered, enhanced and supported participants' reflexivity and transformative agency leading to collective agency. It demonstrates how reflective talk, expressions and actions of transformative agency and the nature of collaboration among participants played a role in decision formation and implementation for transformative praxis. I have used the model as a guide to provide evidence of how the conflict of motives directed participants towards actions to transform their practices. *The discussion in this chapter centres on phase 3 in Apparatus 1 and Apparatus 2.* This is because I have discussed phases 1 and 2 of Apparatus 1 in detail in Chapter 6; however, I will briefly describe these here in order to show the transition. Apparatus 2 was discussed in general in Chapter 7.

8.2.1 Chapita Case Study

8.2.1.1 Transformative Agency Pathway 1: Cooking nsima on the Improved Cook Stove with support
Apparatus 1: Decision forming

Conflict of stimuli: The general conflict of stimuli is socio-cultural (see Chapter 1, Section 1.7.1.1 and 1.4.1) demands *versus* environmental health expectations (see Chapter 6, Sections 6.3.1.4 and 6.3.1.5). The socio-cultural demands of extended big families and responding to environmental health concerns generate a specific conflict of stimuli: purchase of an ICS to save firewood *versus* abandoning the ICS or using it sparingly to satisfy large family demands. After saving money to buy an ICS against the background of poverty (see Chapter 1, Sections 1.4.1 and 1.7.1.1) in order to save firewood, the woman abandons or uses the stove sparingly (see Chapter 6, Sections 6.3.1.4 and 6.3.1.5) and does not achieve the benefits. The conflict of stimuli activate conflict of motives as described below:

Conflict of motives: Cooking *nsima* on the ICS with struggle and save firewood *versus* cooking *nsima* on TSF with convenience and consume more firewood.

First Stimulus: During BCCLWs, the *first stimulus* was the presentation of interview excerpts describing how a woman struggles in cooking *nsima* on the ICS especially for large families, which requires that they use both hands when the *nsima* becomes stiff. It highlighted that the stove favours pots with handles, without which the woman would struggle (see Chapter 6, Sections 6.3.1.4 and 6.3.1.5).

Immediately after the presentation of the first stimulus, a participant expressed 'resisting' a type of transformative agency (see Chapter 3, Table 3.2 for types of transformative agency expressions) in the form of criticism directed towards implementers' approach to dissemination of the socio-technical innovation. She argued that the implementers did not consider how people with large families would cook

nsima on the stove. This immediately was followed by 'explicating possibilities'; she introduced an **external stimulus** to solve the problem and related this to the old cooking practice on the TSF.

Resisting:

> **#³⁶2883-2884 Participant EC:** *The problem here is … that implementers did not scrutinise how people would be cooking [nsima] on the ICS in large pots.* (BCCLW BK2)

She continued with 'explicating possibilities' by relating to the way they cook *nsima* on the TSF using some support, as evidence of unacknowledged potential for the new cooking technology. She also used 'envisioning' by making preliminary suggestions of a new pattern in the cooking activity.

Explicating and envisioning:

> **#2885-2886 Participant EC**: *…However, it is possible to cook in a large pot in the same way we cook on the TSF …* (BCCLW BK2)

> **#2888 Participant EC**: *On the TSF, we find a tree fork and we support the pot with it …,* **#2890** *while our knee presses firmly on the tree fork and we cook without problems. In the same way, we can do it on the ICS. We can get a tree fork, support the pot, press our knee on the tree fork, and cook with two hands without problems, without the pot sliding.* (BCCLW BK2)

In #2888, the participant brings in an **external stimulus**, a tree fork to support the pot when cooking (see Photo 8.3A) to resolve the conflict of motive. This is *phase 3* in apparatus 1.

Auxiliary motive: The participant decided to use a tree fork to make a decision. However, this external stimulus triggered another *conflict of motive* in the participants: between cooking with support on the ICS and saving firewood *versus* keeping the ICS safe from breaking (due to the force exerted from the support) (see Chapter 7, Section 7.2.2) for evidence on the conflict of motives and emotions aroused in the participants. After the emotional conflict, *participant EC* expressed a combination of 'envisioning' and 'committing to concrete actions' to use the suggested tree fork in the form of a preliminary suggestion for a new way of cooking.

Envisioning and committing to concrete actions:

> **#3119 Participant EC:** *It is possible [to cook nsima with support]…* (BCCLW BK2)

> **#3122 Participant EC:** *We will cook on the 15th.* (BCCLW BK2)

At this point individual agency gained **collective agency.** Another participant emphasised the idea by bringing in the need for experimentation. She expressed 'committing to concrete actions' – to try out cooking in a large pot, both with and without support to see what would happen:

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³⁶ The symbol **#** stands for speech turn as indicated earlier (see Chapter 3, Section 3.8.2).

> **#3124-3126 *Participant SB:*** *I am thinking that if it was not that this is about school, I could have suggested that we conduct an experiment. We take flour, a large pot and an ICS and some firewood and experiment.* (BCCLW BK2)

The questioning session in this TAP yielded four types of transformative agency expressions. However, only one instance occurred where individual initiative led to collective agency. It is also worth noting that the researcher interventionist did not introduce a second stimuli up to this point. Yet, the first stimulus sufficed to provoke expressions of transformative agency and the introduction of an external stimulus to resolve the conflict of motives.

Second stimuli – first set: I gave participants a take-home assignment at the end of session 2 to research the causes and conditions of the problematic situation from community members (see Appendix 14). The purpose was to help them understand better their problems from multiple perspectives and to realise that they are capable of changing their own lives. In session 3 the presentation of the causes and conditions of the conflict of motives as indicated in Chapter 6, Section 6.3.1.4 and 6.3.1.5, summarised in Chapter 7, Table 7.1, triggered 'envisioning' and 'explicating' as indicated below. (See also #9968-9969; #9965-9966; #9983-9984).

Envisioning and explicating new possibilities:

> **#5074-5076 *Participant FK:*** *If they had made big stoves like the charcoal stoves. The charcoal stoves come in small and big sizes, maybe if they had done that, so that some can accommodate small pots and some accommodate big pots.* (BCCLW BK3)

Participant FK was referring to a charcoal cook stove the 'Kenyan Jiko', which is one of the common stoves (almost baseline charcoal ICS in Malawi) (see Chapter 1 and 2). She explicated possibilities in the activity of cooking in general by bringing in external positive experiences from another ICS available in the country.

Second stimulus second-set: At the end of session 4, I gave participants a take-home assignment to stimulate them to understand the problems prioritised and begin to model solutions (see Appendix 14). This triggered expressions of agency in session 5 during modelling and examining solutions. During the session, the issue of making big stoves to accommodate big pots gained ***collective agency*** from session 3 (#5074-5076). *Participant KG* used 'envisioning' as follows:

Envisioning:

> **#8356-8360 *Participant KG:*** *I think that there should be two types of designs because as we had already observed, other families are large. Is it not possible to make bigger sized stoves that accommodate the big pots? This can also help them [big families] use the ICS and protect the environment without distressing.* (BCCLW BK5)

By going into groups to compose solutions collectively, different individual initiatives turned into collective transformative agency. Several solutions were proposed and most of these were in the form of envisioning (See Chapter 7, Table 7.2).

During solution examination, participants realised that no solution was modelled for the struggle in cooking *nsima*. One participant expressed the struggle they had encountered in coming up with the solution, and agreed during their group discussions that they should not model a solution pertaining to that because there was no big stove that could accommodate big pots as suggested above. She did this using 'committing 'not' to concrete actions'. Commissive speech acts also include decisions not to take actions (Qadir & Riloff, 2011). This indicated that participants had considered only one suggestion. The tree fork was not supported, probably because of the conflict of motives it had triggered earlier.

Committing 'not' to take concrete action:

> **#9697-9698 Participant KG:** *In our group, we felt that since we do not have a big stove that can accommodate large pots, we cannot cook on the stove with a big pot … **#9701-9702** and we did not explicate anything because we felt that it would be of no purpose.* (BCCLW BK5)

The group committed 'not' to take concrete action. This was a disturbance, an unintentional deviation (Engeström, 2008) from the learning action of modelling solutions. The disturbance activated 'commitment to take action' and 'reflexivity on the practice of device stacking' (see Chapter 2, Sections 2.4.1), which *participant RK* echoed was a problem.

Reflective talk: Examining one's practice in order to change it and 'implicit' committing to concrete actions:

> **#9703-9707 Participant RK:** *But that is a problem because we continue stacking between TSF to ICS, ICS to TSF. We still need to find something that should help us. We need to think about what kind of stove can help us cook nsima in a big pot without struggling. It is obvious that we use two hands when cooking nsima and it is not possible to cook nsima on that stove without support.* (BCCLW BK5)

In the excerpt above, *participant RK* used an 'implicit' commissive speech act; '*we need to think about what kind of stove…, it is not possible to cook nsima on that stove without support'.* An implicit commissive speech act is an implicit commitment about intended actions, as opposed to commissive speech acts in which a speaker commits to future course of action (Qadir & Riloff, 2011). *Participant RK* implicitly committed to searching for solutions in the form of a new stove design or some type of support for the stove. Following this commitment, *participant KG* brought back the use of a tree fork:

> **#9708-9710 Participant KG:** *During our group discussion, I suggested to put the solution suggested by participant EC. However, it seemed we did not agree. I was thinking that the tree fork should be part of the solution to that problem*. (BCCLW BK5)

This suggestion triggered the same conflict of motives as explained earlier. Participants felt that the tree fork would break the stove. Participants instead seemed to favour changing of mould to produce big stoves. The idea gained **collective agency** again. One participant suggested that a big stove be produced and they should experiment cooking *nsima* in a big pot. This triggered participants to compare different stoves and they realised that many stoves require some support, or use of one hand which becomes problematic with cooking *nsima* for big families. This prompted one participant to suggest that stove designers should come up with a culturally appropriate stove:

Envisioning:

> **#9774-9777 Participant RK:** *At this point, my suggestion is that the stove designers should reflect and do research to produce a culturally appropriate stove that allows cooking* nsima *in a big pot. Because this problem is common even on the other types of stove [referring to charcoal stove]; it is still difficult to cook* nsima *in a big pot. It only allows small to medium pots.* (BCCLW BK5)

Notice the shift in expressions of agency in *participant RK* leaning towards changing stove design (#9774-9777), from the two initial suggestions (#9703-9707). After a long deliberation, the idea of using a tree fork was brought in again with the researcher's intervention:

> **Researcher:** *Let us continue to search for a solution on this one because it appears that it has been difficult to find a good one … We should come back with a solution on Monday; we can ask others in the community.*

Envisioning:

> **#9965-9966 Participant KG:** *But I had asked three people. They told me the same solution suggested by participant EC.* (BCCLW BK5)

> **#9968-9969 Participant KG:** *They told me that they use a tree fork when cooking* nsima *and it works. They all explained in the same way.* (BCCLW BK5)

The conflict of motives as discussed earlier led participants to demonstrate how the tree fork is used using thought experiments. In so doing, they removed the fear that prolonged participants to resolve the conflict of motives.

Envisioning:

> **#9983 Participant KG:** *The tree fork grips the pot not the stove.* (BCCLW BK5)

> **#9984 Participant EC:** *If you take a short tree fork, then it will be hitting the stove, you need to find a longer tree fork.* (BBCLW BK5)

Notice how *participant KG* is determined to support the use of a tree fork (#9708-9710; #9965-9966; #9968-9969). She is focused in her suggestions, adding information obtained from the research they conducted with community members. Yet when *participant EC* introduced the idea and repeated it once in Session 2, she never mentioned it again until Session 5 (#9984) when participants almost reached a

consensus. Hence, it appears that in some situations, individual agency requires determined and focused individuals to transform into collective agency.

Real conflict of stimuli and closure of conditioned connection: This phase occurred in two scenarios. In the first scenario, it may have occurred at the same time about one month after the last session of BCCLW (see Appendices 11 and 14). Participants were provided space to present the proposed stove design at the Cleaner Cooking Camp 2016 (See also Section 8.2.1.2- real conflict of stimuli sub-pathway cumbersome production process). However, this did not progress to apparatus 2 due to the feedback obtained from participants at the conference (see Chapter 7, Section 7.2.6.1).

In the second scenario, it occurred during follow-up community visit, a day before follow-up workshops, four months after the last session of BCCLW (see Appendix 11). One participant identified a piece of wood for supporting a pot and sets up the cooking apparatus; a big pot without a handle, a stove and a cooking stick (see Photo 8.1A). (See also Appendix 13, Video clip MV_0001. MP4 from 00:31:39 minutes.) The participant then conducted an imaginary demonstration on how to cook *nsima* in a large pot without a handle, on the ICS with the piece of wood leaning against the pot (see Photo 8.1B). (See also Appendix 13, Video clip MV1_0002.MP4.)

Photo 8.1A   Photo 8.1B

Photo 8.1: Video still showing phase 4 in Apparatus 1 (Chisoni, June 2016b)

Second stimuli – third and fourth set: The second stimuli third and fourth set was the imaginary demonstration (Photo 8.1B) and a picture of a woman cooking with support on a different type of stove (not in Malawi) (Photo 8.2) (Moore-Delate & Roth, 2016). The stimuli reinforced and concretised participants' transformative agency leading to implementation of the decision in a real life situation.

Photo 8.2: Second stimulus
Source: Moore-Delate & Roth, 2016

Apparatus 2: Decision implementing

Decision implementation occurred after follow-up workshop 2, three days after the imaginary cooking demonstration.

Taking consequential actions to change the activity: During follow-up workshop 2, participants concretised the agency to experiment cooking *nsima* with support using the tree fork. The plan involved a simple budget for purchasing foodstuffs and time for conducting the experiment. When I arrived, participants had set up the apparatus: they had fetched a garden-fresh tree fork from the bush, of the size that would fit and grip the pot, they had made a fire and cooked relish and the porridge for making *nsima* was ready. Participants cooked *nsima* with support (see video still Photo 8.3D). (See also Appendix 13, Video clip MV1_00012.MOV.)

| Photo 8.3A | Photo 8.3B | Photo 8.3C | Photo 8.3D |

Photo 8.3: Video still showing the transitions in cooking nsima with tree fork support (Chisoni, June 2016b)

In Photo 8.3A, the participant supports the pot with one hand to demonstrate the struggle involved, while the tree fork lies on the ground. In Photo 8.3B, the participant removes the hand, both pot and stove slide; in Photo 8.3C the participant uses the tree fork to support the pot, but the pot slides; in Photo 8.3D, the participant uses the tree fork with stability to support the pot and she cooks with the vigour required.

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Mode of interaction: In this pathway, all actors' critical attention was on the shared object. This may be because the conflict of motives did not concern specific roles of actors. It concerned all the activity systems present during the BCCLWs as users of the technology; except the implementers who were absent, as discussed in Chapter 3, Section 3.5.5.3. The concerns were directed towards stove designers and implementers. Their presence could have probably changed the mode of collaboration.

8.2.1.2 Transformative Agency Pathway 2: Revamping stove production group, producing stoves and increasing stove price

This TAP has three related sub-pathways: (1) scarcity of stoves were due to (2) cumbersome stove production process, exacerbated with (3) low stove prices (see Chapter 9, Figure 9.1, TAP2). The discussion will weave the sub-pathways in the way participants dealt with them during BCCLW.

Apparatus 1: Decision forming

Conflict of stimuli: The general conflict of stimuli is socio-economic demands *versus* environmental-health concerns. A more specific conflict of stimuli is the lack of a source of livelihood and income generation activities for the women producers *versus* the demands for promotion of low-cost technologies to address environmental health concerns (see Chapter 6, Section 6.3.2.5 and 6.3.2.9). Another general conflict of stimuli is societal environmental health concerns *versus* personal health and safety concerns of the women producing the stoves (see Chapter 6, Section 6.3.2.5). This general conflict of stimuli generates a more specific conflict of stimuli: committing to solving 'intangible' societal and personal environmental health problems *versus* a concern for tangible personal health and safety problems.

Conflict of motive: The conflict of stimuli activate a conflict of motive in the subjects of the production group activity system: to continue stove production while generating a little income out from stable-labour-intensive work *versus* dropping stove production and generating more money out of unstable piece work with less labour. Another conflict of motive is between staying in stove production with stove price raised *versus* maintaining the status of a defunct stove production group.

First stimulus: The first stimulus was the presentation of the excerpts from interviews conducted with the production group where women complained about the cumbersome production process (see Chapter 6, Section 6.3.2), how they were injured in the process, how this led to defunct production groups and complaints around the lack of tools, specifically a production house.

After the presentation of the excerpts, one participant elaborated on the hard work involved in stove production. This triggered a 'resisting' transformative agency expression from another participant. She criticised and questioned the practice of ICS production and asked the researcher interventionist whether

this kind of hard work is appropriate for women. She continued explaining that those who dropped the production group did the right thing to protect their bodies from harm:

Resisting:

> **#2495-2501 Participant KG:** *Aha teacher [researcher]! Imagine! The way [name of person] has explained about the pit, full of clay, with an arm as frail as mine, then you start pounding ... pounding. Do you think it is helpful? Will you be feeling all right by the time you complete that activity? If someone has heart disease by the time she completes the activity she would have triggered it! Eee! So, those who dropped the production were not wrong. In fact, they were protecting their bodies.* (BCCLW BK2)

The expression of transformative agency resistance was a restatement of the conflict of motives as described above and it reactivated the conflict of motives during the session. Participants appeared lost but no one verbally expressed the conflict of motives. In my analysis, the conflict of motives was between continuing with the cumbersome production process with the object to protect the environment *versus* protecting their bodies from harm. This meant maintaining a defunct stove production group.

Second stimuli – first and second sets: At this stage, I introduced second stimuli-first set in order to help participants move out the conflict of motives. First, I called upon the participants to recall the *shared object* and to relate it to the transformative agency expression from *participant KG* (#2495-2501). Second, I highlighted the *interconnectedness* between the various problematic situations that participants had mentioned during interviews from the first phase. This included presentation of excerpts about the scarcity of stoves, which led to low uptake by potential users, failure to meet stove demand and problems concerning transportation of stoves (see Chapter 6, Sections 6.3.2.5). Additionally, I linked the excerpts to the hard work involved in the production of stoves and defunct stove production groups. In this regard, the problematic situations, which were supposed to serve as first stimulus, (for stove scarcity) were converted to second stimuli and acquired a new concept: *interconnectedness,* which was thus the second stimuli-second set.

The interconnectedness led to voicing of other expressions of agency in the form of 'explicating new possibilities' and 'envisioning'. A participant characterised the problematic object of stove production as a source of new possibilities to scale up production and stove uptake amidst the challenging stove production process that affects stove availability:

Explicating and envisioning:

> **#2539-2547 Participant ECH:** *There are few producers. If people are dropping out, then there is need to introduce the stove technology in other places such as Mangochi, Machinga. People in those places were supposed to be trained in stove production so that people can access the stove quickly. If they [implementers] only rely on one place or few places, it will be problematic. If production places were established in many places then when some members drop out, there*

would still be a good number remaining in stove production. That would be better. If only few places will be producing, then, it would not work because this work is hard. (BCCLW BK2)

This was followed by 'envisioning'. Another participant proposed a new pattern in the work activity of stove production suggesting that implementers should assist in provision of food items for the production group when they do their work.

Envisioning*:*

> **#2572-2574 Participant SB:** *Maybe the implementers should take part in assisting the producers with, say a bag of maize so that they can have some food when making the stoves. I think that the women may not drop production because they would have food while making stoves.* (BCCLW BK2)

Another participant suggested increasing the price of the stove. The participant called for a decision to follow one path of the conflict of motives as described above: '*to stay in stove production and raise stove price.*'

> **#2617-2618 Participant MM:** *… I think that if they could increase the stove price a little maybe we could feel that we are suffering for a good cause.* (BCCLW BK2)

After the suggestion to increase the price, there was a general feeling among participants that raising the price could help solve the problem regarding the hard work involved in stove production and resolve the conflict of motives. However, when I presented the second set of second stimuli, the *interconnectedness* on price raising from the end-users' perspective, another *conflict of motives* was activated. The excerpts described how end-users are failing to purchase the stove because they cannot afford it even though they admire it (see Chapter 6, Section 6.3.29). The conflict of motives was: producers raise the price, make many stoves and meet the demand *versus* end-users cannot afford, stoves would be stockpiled. This conflict of motives is captured in the following excerpts:

> **#2681 Participant RA:** *If we cannot afford 600, and then it is raised to 1000, are we going to afford?* (BCCLW BK2)

> **#2692-2696 Participant RB:** *Yes, we agree it is hard work. … I bought at 350, but now I can't manage because it was raised to 600 even though I really wish to buy. Now they [producers] are saying 600 is little and they want to raise, we can't afford, we are not going to purchase. But I wish so much to cook on the stove. At the same time, I know this work is hard because I see how that woman works. They are not lying it is hard work. But then they are saying 600 is little, I don't know… anyway...* (BCCLW BK2)

This conflict of motive is expressed as a form of 'resistance'. *Participant RA* initiated it (#2681) and it gained *collective support* from *Participant RB* (#2692-2696). Both questioned and implicitly opposed some aspects of the ICS practice. This influenced one participant to 'commit to take action'. He expressed an 'implicit commissive speech act': to commit himself and at the same time calling for other participants to hold a discussion concerning price increase geared towards resolving the conflict of motives.

Auxiliary motive on sub-pathway low stove prices: The participant used a '*meeting*' as an ***external stimulus*** to help in resolving the conflict of motives, *Phase 3 in Apparatus 1*. This gained ***collective agency*** during follow-up workshop 1 from *participant SZ and SB*, but this time they extended it to include the implementers (#20543-20546; 20589). (See also #8959-8966.) Before 'committing to action,' *participant EJ* 'explicated new potentials' by relating to the past positive experiences that implementers worked on in helping producers determine prices for specific communities.

Explicating and committing to concrete actions:

> **#2722-2728 Participant EJ:** *The establishment on the price at the beginning was based on the economic status of the community adopting the ICS technology. They [implementers] were asking us producers to determine the price, which potential users can afford. At that time, we came up with a suitable price. Now we see that the work is hard and we would like to raise the price; it is not someone else who would raise the price. We need to sit down together and discuss.* (BCCLW BK2)

Envisioning, and confronting and navigating power relations:

> **#20543-20546 Participant SZ:** *I think that before we raise the price we should sit down and examine. But first, before we have a meeting with the community members we need to have a meeting with the field facilitators from Concern Universal because they have the power to purchase the stoves and sell them elsewhere. If we do that, we will make good progress.* (FUW BK1)

> **#20589 Participant SB:** *We should also hear their [Concern Universal] side of the story.* (FUW BK1)

> **#20590 Participant SZ:** *I really think that only Concern Universal can help us to reach our decision.* (FUW BK1)

Participants recognised the power they had and the power they needed to navigate in order to make progress with price adjustments.

The general structure of cooperation: Apart from illustrating transformative agency expression, # 2722-2728 also indicated that the participant's critical attention was on the shared object (see Chapter 3, Figure 3.6B). This shift was triggered by the conflict of motives (# 2681; 2692-2696). Hence, the mechanism of the transition is *expansion*.

Further, another participant reacted to the 'interconnectedness' with *reflective talk.* The participant examined the ICS practice in terms of overreliance of producers on the transportation provided by the implementers and thought that it was not a sustainable way of doing things. She called upon fellow participants to reflect about the future of the practice in relation to the present way of doing things.

Reflective talk: Examining one's own practice in order to change it, envisioning and implicit committing to concrete actions:

> **#2752-2756 Participant DC:** *It is good that sometimes they [implementers] provide us with transportation for the stoves. However, our activities involve production, promotion and use of the stove in order to protect forests and environment. This is not about today and tomorrow, we want a sustainable practice. Today we have vehicles to transport the stoves. What are we going to do when we will not have transportation?* (BCCLW BK2)

In #2752-2756 the participant first suggested a new model of practice; this relates to 'envisioning' (# 2572-2574) because the two preliminary suggestions culminated in one comprehensive model for the future (see Chapter 7, Table 7.5., tools/instruments 6). Second, the participant used 'implicit commissive speech act' and called upon fellow participants to incorporate ideas of sustainability in their practice in the process of resolving the conflict of motives.

Second stimuli – third and fourth sets: The third set of second stimuli was the take home assignment between Sessions 2 and 3, used for the same purposes as indicated in TAP 1 (Section 8.2.1.1). In session 3, I used the triangular model to stimulate participants to discuss the root causes and conditions of the cumbersome production process. These stimuli in combination led to expressions of 'envisioning'. One participant suggested that the producers need protective gear for the hands as discussed below.

Auxiliary motive on sub-pathway cumbersome production process: The participant brought an *external stimulus,* the 'protective gear' to aid in decision-making. The external stimulus provoked more envisioning expressions. They included protective gear for the hands (#4857-4862), training for new production group members (#4881-4883) and of particular significance, bringing in Chiefs to designate an area for tree planting (# 8805-8815) as well as launching a request to stove designers (# 8973-8976). These were carried further (see Chapter 7, Section 7.2.6.1).

Envisioning:

> **#4857-4862 Participant KG:** *There is need for some tools. The implementers could have brought them tools just like the ones they brought for maize shelling. They need tools to protect the hands when they are scraping inside the moulds and for pounding the clay in the moulds. This could help in easing the pain, unlike the way things are now; they only rely on the bare hands.* (BCCLW BK3)

The participant related the activity of stove production to a maize shelling activity also happening in the community. This transformative expressions gained ***collective support*** (#4865):

> **#4865 Participant FK:** *They were supposed to be wearing protective gear.* (BCCLW BK 3)

> **#4881-4883 Participant EC:** *I also think that the problem is because the people involved in stove production are the old members who were trained long time ago when the ICS technology was implemented. If they were training more people in different districts, I think that the problem with stove scarcity would have been reduced.* (BCCLW BK3)

This expression follows 'explicating' and 'envisioning' (#2539-2547). This is evidence of ***collective agency.***

Initially it had seemed as if a decision was reached about raising the stove price to resolve the conflict of motives as indicated above. However, there was a twist. After a participant had reported on the causes and conditions giving rise to the problematic situation (see Chapter 6, Section 6.3.2.5), from the assignment completed at home, end-user(s) expressed 'committing 'not' to take actions'. One of the suggestions in her presentation was to increase the price. However, there was consensus that end-users cannot afford any price increase because some were failing to afford the current price (#2681; 2692-2696). Hence one participant spoke on behalf of all end-users (she used "we"). This is evidence for **collective agency.**

Committing 'not' to take concrete action:

> **#4963-4965 Participant FK:** *That is why we are saying if the stove goes up to 1000, you will pile your stoves [because we will not buy]. But if it remains at 600, at least we will come to buy. But at 1000, it will not happen.* (BCCLW BK3)

The participant(s) committed 'not' to purchase stoves if the price would be raised to MWK1000 (US$1.40). On the other hand, she made commitment to purchase stoves if the price remains at MWK600 (US$0.84).

The general structure of coordination: In the quote above (# 4963-4965), participants' critical attention was on themselves as end-users, without focusing on the shared object (see Figure 3.6A). Similarly, producers critically focused attention on themselves rather than on the shared object (#4983-4984):

> **4983-4984 Participant SB:** *Mine is a comment. It is good that they [end-users] have realised that stove production is hard; hence, when they [producers] would raise the price they would not be surprised.* (BCCLW BK3)

Participant SB as stove promoter would benefit from price increment because she sells stoves (Chapter 5, Section 5.2.1.3). Notice how her comment disregarded the comment from end-users (#4963-4965). She 'implicitly commits not to take action' to resolve the conflict of motives around the price.

The general structure of coordination, committing not to take concrete action and voicing power relations: The comment from *participant SB* (#4983-4984) aroused transformative agency expression and reflective talk. One end-user 'committed 'not' to take action' and 'voiced power relations'. The mode of interaction remained *the general structure of coordination.* This is evidenced in the following excerpts:

> **#4987-4991 Participant RB:** *Now she says when we go home we should not be surprised when they [producers] raise the price. Well, and we are saying, that is all right! But then, we have a choice, we know exactly what to do. … Do you think I can do piece work, make MKW2000, and take it and buy a stove? No! So, I am saying we have a choice to make. Can development progress with that kind of thinking? Can development progress if only three people buy a stove?* (BCCLW BK 3)

> **Researcher:** *What do you mean when you say you have a choice?*

> **#4993 Participant FK:** *Yes, we will just stay home [will not buy].* (BCCLW BK 3)

Researcher: Oh, I see, you mean you will decide to do nothing about it. (BCCLW BK 3)

#4994 Participant RB: *Exactly! We will keep quiet. We will just say, oh ok, thank you [for increasing the price]. I will buy next year and others [end-users] will make their own decisions.* (BCCLW BK 3)

In #4987-4991, *Participant RB* stuck to the general structure of coordination and voiced the power they have in the progression of the ICS innovation uptake by declaring that end-users have a choice to buy the stove or not. This indicates a 'commitment 'not' to take action'. The decision not to take action gains **collective agency.** Initially initiated by *participant FK* (#4963-4965), then *participant RB* supports it (#4987-4991) and it was emphasised again in (#4993) by *participant FK* in response to the researcher's question and echoed by *participant RB* (#4994).

Transitioning from coordination to the general structure of cooperation and reflecting on the social world: In the last two questions of #4987-4991, *Participant RB* shifted from coordination to cooperation. Using rhetorical questions, she called upon participants to reflect on the way of thinking of the previous speaker [#4983-4984] and the implications it has on advancing development.

Second stimulus fifth-set: At the end of session 4, I gave participants a take-home assignment to stimulate participants understanding of the problems prioritized and to begin to model solutions (see Appendix 14). This triggered a number of envisioning expressions from participants in session 5 when participants were modelling solutions. *Participant RK* expressed 'envisioning' in the citation below in relation to resolving the price issue (#8376-8383).

Envisioning:

> **#8376-8383 Participant RK:** *Even though we have financial problems in the village, I think that, if the government is advocating the use of ICS to save firewood then, Village Headmen are supposed to take part in facilitating that every household has a stove and use it. They can even command that, whether one likes it or not, they should use the stove and if they do not they should pay a small penalty. Maybe people would have been using the stove to help protect the environment, despite that it is slow.* (BCCLW BK5)

Following this, the researcher asked participants whether people could use the stove despite it delaying cooking, since this was one of the major contradictions constraining stove use (see Chapter 6, Sections 6.3.1.1 and 6.3.1.2; Chapter 4, Section 4.3.3.4; see also Section 8.2.1.3). This evoked reflexivity from *participant SB* in support of the transformative agency expression from *participant RK* (# 8376-8383).

Reflective talk: Examining one's own practice in order to change it and the general structure of cooperation:

> **#8389-8391 Participant SB:** *I would like to support what the previous speaker has just said. What she is saying is true because if we continue to cook on the TSF, we will continue destroying the environment. What will the future generation use for cooking?* (BCCLW BK5)

It appears that the transformative agency expression evoked *Participant SB* to be reflexive on the practice of device stacking and its implications on future generations. She shifted from coordination (# 4983-4984) and attempted cooperation without reconceptualising or addressing end-users' price concerns. Hence, her focus was on a partially shared object (see Figure 8.1) considering use before resolving problems on stove uptake.

During this session, several participants expressed 'envisioning' since it was on modelling solutions. I have highlighted a few excerpts that were carried further to phases 4a and 4b and apparatus 2 to illustrate this.

Envisioning:

> **#8352-8353 *Participant RB*:** *We need to increase production group members to increase stove production.* (BCCLW BK5)

> **#8406-8407 *Participant EC*:** *I think that if they [implementers] had brought us machines for making stoves so that we should not feel the pain when making stoves; we could have been producing many stoves.* (BCCLW BK5)

> **#8411-8414 *Participant SZ*:** *I was thinking that if we can increase the price of the stove, we may attract many producers, and they would not be seeking for piecework. It can also increase their interest on stove production.* (BCCLW BK5)

By going into groups to model solutions, different individual initiatives turned into collective transformative agency. Several solutions were proposed and most of these were in the form of envisioning as described in Chapter 7, Table 7.2.

The general structure of coordination: During examination of solutions, I observed a *general structure of coordination* (see Figure 3.6A). One participant questioned a solution to encourage designation of a specific land for accessing firewood for stove firing, which was meant to ease hard labour associated with stove production process in the future:

> **#8767-8768 *Participant KG*:** *Can I ask a question about the forest that you are referring to in that solution? Is it a forest that belongs to the producers or it is the one belonging to the community?* (BCCLW BK5)

Following this, a stove production group member clarified that the solution meant a request to the implementers to continue supplying them with tree seedlings as they used to do in the past to replace trees they cut for firing stoves. *Participant KG's* reaction clearly indicated coordination as an end-user:

> **#8780-8782 *Participant KG*:** *I am asking because, the community forest, the one that is looked after by the Chiefs committee, is for the benefit of the community and community members are responsible for weeding. Why should producers who are making their own money, get firewood for firing stoves from there and make profits from it?* (BCCLW BK 5)

Participant KG overlooked the fact that producers are community members and that replanting trees is also for the benefit of the community.

Reflective talk: Examining one's own practice in order to change it, reflecting on the social world and envisioning: In examining the above solution and in response to *participant KG* above (# 8780-8782), *participant SB* reflected on the practice and its implications for future generations. Within the same quote, she used 'envisioning', suggesting that the implementers and the Village Chief should help the production group with tree seedlings and a place for planting trees. She also suggested collaboration with government as a permanent structure rather than the NGO because they phase out their projects:

> **#8805-8815 *Participant SB:*** *Producers need firewood for firing stoves. Just imagine if they cut trees for three years without planting a single tree, where would they get firewood for firing the stoves that they would produce in the subsequent years. So, I would like to suggest that producers should be given a designated area where they can plant trees for firing the stoves. In that way, the ICS practice will be sustainable. Most of the producers purchase firewood, what will happen if trees will be depleted where they purchased? Will the future generation not produce stoves? Therefore, a strategy has to be put in place; the organisation [implementers] has to take part, in addition the Village Headman should provide the production group with a piece of land where they can plant trees for firing stoves in order to make stoves available. … I think the best are the Department of Forestry because they belong to the Government unlike the organisations because they would leave.* (BCCLW BK5)

The citation from *participant SB* (# 8805-8815) may imply that the general structure of coordination may trigger reflexivity; on the other hand, reflexivity may trigger transformative agency expressions. *Participant KG* (#8831-8833), in **collective support** to *participant SB,* expressed 'envisioning', supported the suggestion to designate land for producers for planting trees.

> **8831-8833 *Participant KG:*** *That is the solution I wanted, that the producers should be given a designated place because they would manage it themselves … If they are given a place, that would be better.* (BCCLW BK5)

As examination of solutions continued, I needed to capture concrete ideas on how to proceed with the sub-pathway on low stove price. This triggered **collective agency** in the form of 'committing to taking actions'.

Committing to take concrete actions:

> ***Researcher:*** *So what can we do to make sure that the solution is implemented and it works?*

> **#8880-8881 *Participant SZ:*** *We will need to explain to the end-users that by such a date the stove price will go up.* (BCCLW BK5)

> **#8884-8886 *Participant SB:*** *And explain properly the reasons behind that … In addition, find important reasons that would help people to understand better.* (BCCLW BK5)

Notice how this decision was concretised and gained **collective agency** from *participant EJ* in Session 2 (# 2722-2728). There was collective effort in organising a 'meeting' between producers and end-users to explain to them the reasons for raising the price. This collective agency continues below (# 8944; 8946-8950; #8953-8958; #8959-8966).

Participant SB continues to elaborate on how to implement the price increase solution. In her explanation, I was able to trace a shift from *coordination (# 4983-4984)* to *reflexive communication* (# 8886-8895) (see Figure 3.6C). In #8886-8895, she shifted her critical attention to the shared object; additionally, the interaction between actors and the script, 'low cost technology for the rural poor' was reconceptualised by suggesting that a middle ground should be negotiated.

The general structure of reflexive communication:

> *#8886-8895 Participant SB:* But we also have to think about the value of our currency when we talk about raising the stove price. At the same time, it is difficult for people in the village to find money. Hence, to think about buying the stove at MWK1000, one would feel that it is better to buy soap for washing clothes instead, than to buy a stove. We need to do something that would help us to achieve our object … Therefore, we need to agree on one thing so that buyers should be happy and producers should be happy as well. We should not rush at increasing the price, at the same time we should not reduce the price, but we need to find a middle ground so that everyone is happy because the people who buy stoves are the poor villagers. (BCCLW BK5)

In this case, the mechanism of transition between 'coordination' and 'reflexive communication' was *expansion.* No immediate preceding disturbances triggered the shift. However, at this point, I needed participants to examine the solution properly because it was controversial. My questions triggered end-users to voice out their power in determining the course of action in the activity as evidenced in the speaking turns below:

Confronting and navigating power relations and envisioning:

> *Researcher:* I just wanted us to examine this solution properly. … because the problem now is that end users need the stoves but they are not available, now you raise the price to make them available but then they would feel that the price is…

> *#8918 Participants:* High. (BCCLW BK5)

> *Researcher:* The stoves will be available but they would not...

> *8920 Participants:* Buy. (BCCLW BK5)

> *Researcher:* Can we experiment on this solution? Can it help us to make the stoves available for the end-user?

> *#8923 Participant SB:* We should experiment. (BCCLW BK5)

> *#8924 Participant FK:* They should experiment. (BCCLW BK5)

> *#8930 Participant KG:* They (producers) should request us. (BCCLW BK5)

> *Researcher:* They should request you?

> *#8932 Participants (mostly end-users):* Yes. (BCCLW BK5)

> *#8933 Participant KG:* They need to request us. (BCCLW BK5)

> *#8934 Participant FK:* In a calm manner. (BCCLW BK5)

> **#8935 *Participant KG:*** *They [producers] should not just raise the price while seated at their homes. They should request us [end-users] that, "we want to raise the price", and we should give them advice and tell them to raise – tell them to raise considerately.* (BCCLW BK5)

> **#8937 *Participant SB:*** *The price should be negotiated.* (BCCLW BK5)

> **#8944 *Participant ECH:*** *But the main point is on organising a meeting as I said initially.* (BCCLW BK5)

> **#8946-8950 *Participant ECH:*** *The first thing should be briefing the people about what they should expect. Hence, they would be aware by the time things are implemented. That would help making sure that implementation is smooth.* (BCCLW BK5)

> **#8953-8958 *Participant KG:*** *… We would like them [producers] to call us [end-users] for a meeting on stoves. And when we attend the meeting, they should explain to us that "it has been so long that we have been producing stoves, and that it is hard work as you know, therefore we would like to raise the price". Then we should ask them, "how much is your offer?" If they tell us a price we cannot afford then we will have to acknowledge that the work is hard, then start negotiating the price. We will need to negotiate[37] and discuss while we are together.* (BCCLW BK5)

Notice how the end-users *participant FK* and *KG* were voicing their power (#8930; #8933; #8934; #8935). *Participant FK* said that producers should be calm when making the request to raise the price, controlling their emotions. On the other hand, *participant KG* directed how the producers should approach the end-users in the suggested meeting, giving them the words they should use; this is traced in the way the participant changes from indirect speech to direct speech (#8953-8958) to change the future course of action. The direct speech is a powerful tool that shows the power end-users have in changing the ICS activity. Changing the type of speech can be a sophisticated tool used by participants in collaborative forms of work and in the transitions from one mode of interaction to another (Engeström, 2008)(see below). As regards 'envisioning', the initial suggestion to organise a meeting was developing into a more comprehensive plan for the future. End-users recognised and started voicing and using the power in them to direct the implementation of the solution (see also #4987-4991; #4993; #4994). This also reflects the local cultural practice of negotiation as indicated above.

A movement between coordination and cooperation: Notice how the promoter *participant SB* used *'we'* (#8923), yet the end-users (*KG* and *FK*) used *'they'* (#8924; #8930; #8933; #8935) referring to the producers. While the promoter is focusing the attention to the shared object, the end-users focus on their roles as users of the technology. Interestingly, *participant KG* at the end agrees with *participant SB* on the need to negotiate the price (#8935; #8953-8958).

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[37] Negotiation especially in business transactions is a widely practised culture in Malawi.

While end-users use their power to direct the implementation of the solution, producer *participant ECH* below recognised the limitation in the power they had, expressing limitations in knowledge about the stove and what determines price adjustments.

Confronting and navigating power relations:

> **#8959-8966 Participant ECH:** *But that type of research [discussion] should not involve community members alone. I refuse that. For us to understand things, we rely on the implementers. They are the ones to come in the village to talk about this [price] issue not us producers or the promoter holding a meeting. I think that cannot work. The villagers may not understand and appreciate it. We need them so that we understand whether things have changed, where we are at and where the development is heading. Maybe we as producers we do not know how they do things at their office. This will be a chance for us to understand some things.* (BCCLW BK5)

This limitation may be rooted in the way producers were trained in stove production as discussed in Chapter 6, Section 6.5.2.1. At the same time, it is significant in mediating new ways of doing things in the activity, the need for collaboration and interaction among key actors.

Further, I needed to capture concrete ideas on how to proceed with the sub-pathway on cumbersome production process in relation to tools. This triggered expressions of agency in the form of 'explicating' and 'implicit committing to taking actions'.

Explicating and implicit committing to concrete actions:

> **Researcher:** *We have also mentioned about changing the moulds and introducing machine for smoothening clay soil … Do you think this is feasible, that the moulds can be changed?*

> **#8973-8976 Participant EJ:** *It is possible to change using the same procedure they used when changing from the first moulds to the second. If we can agree here to launch a request, they can make a new mould basing on the request, in the same way they did with the second one. It would now depend on them to change.* (BCCLW BK5)

The participant used implicit commissive speech act to evoke other participants to launch a request to the implementers who lead in designing of the Chitetezo Mbaula. This transformative agency expression also gained *collective effort* from *participant SB* below.

> **#8978 Participant SB:** *Yes, I agree with him.* (BCCLW BK5)

In session 7, I presented the outcome of consultation meeting with the SEMU officer about poor clay soil at Chapita. Participants were disturbed and they wondered how to proceed with the experimentation on revamping the stove production group and producing stoves. The following citation from field facilitator was reported:

> **#7703-7704 Field Facilitator AC:** *… People have the expertise, but they do not have good clay, yet they are determined to produce because they want to make money.* (CM BK)

This allegation triggered a *conflict of motives,* between going forward with the experimentation, to making stoves available with poor clay soil *versus* dissonance and doubt propelling and strengthening the status of the defunct production group. This conflict of motives is expressed in the following citations:

> **#11301-11302 Participant FK:** *So now that they [implementers] are saying the clay soil is poor, considering our program [experimentation], do you think the women producing stoves will have motivation to do the work after hearing this?* (BCCLW BK7)

> **#11312 Participants:** *They [implementers] have discouraged us.* (BCCLW BK7)

Apart from triggering a conflict of motives in the participants, the comment from the SEMU officer (#7703-7704) reflected the *general structure of coordination.* In his comment, he focused on his role as project implementer, without focusing on the shared object of ICS promotion. This triggered expressions of agency from participants. One participant expressed 'committing to take actions' to help participants resolve the conflict of motives:

Committing to take concrete actions:

> **#11419-11424 Participant RK:** *Teacher, I think it is good because we are learning here. Our idea is to go forward not backwards. We will not stop because they [implementers] have said that. This requires that the producers sit down and strategies because the implementers want to abandon them, they should be determined to go forward. We will now see what they [implementers] will do about that.* (BCCLW BK7)

Participant RK above turns the negative feeling into a positive action for future, specifically reenergizing participants to proceed with the planned experimentation (see also Chapter 7.2.6.5). This commitment gained **collective agency**. The following excerpts illustrate this:

> **#11505-11514 Participant SB:** *The fact that Chapita's clay soil is poor should not be a barrier. Let us go forward. … The stoves produced in the past years are still functional, the very stoves the women have been saying they are saving firewood, and they are failing to cook* nsima *with. …. So, that issue cannot be a barrier for Chapita to produce stoves.* (BCCLW BK 7)

> **#11600-11603 Participant RK:** *As for now, it looks there is no opportunity … but if we encourage ourselves when we go back to the village and work hard in stove production, even if they [implementers] are saying the soil is poor, but if we strongly collaborate, the opportunity … will be found in future.*(BCCLW BK 7)

Apart from committing to taking concrete actions, *participant RK's* comment (#11600-11603) reflected a shift to *cooperation,* focusing on the shared object through experimentation, targeting at transforming the activity. The mechanism of transition in this case was the disturbance from the *Field Facilitator AC. Participant RK* continued to commit to concrete actions.

Committing to take concrete actions:

> **#11896-11903 Participant RK:** *My suggestion is that we start with revamping the group before we can organize community meetings. This is because when the group is active and start producing stoves, then we can have meetings when we have a purpose for the meetings. We need*

to revamp the group and start making stoves even though we still do not have the new tools, we can still use the old tools … (BCCLW BK7)

Auxiliary motive on sub-pathway scarcity of stoves: In #11896-11903 above, *Participant RK* summed up the decision to use the 'old complicated tools' and 'poor clay soil' to resolve the conflict of motives on stove scarcity.

Real conflict of stimuli and closure of conditioned connection on sub-pathway scarcity of stoves: Phase 4 occurred at the same time in several stages. First, participants developed action plans to revamp the production group and to produce stoves. Second, participants collected the old production tools from the old production group members to make sure that they had all the required tools. They also purchased tools for making handles and pot rests because they were not available. Third, participants mobilised both old and new members to join the production group and formed a committee to oversee stove production activities and fourth, they collected the clay soil. By completing the tasks, participants decided to revamp the production group and to produce the stoves. The excerpts below illustrates how the subjects were confronted with the alleged poor clay soil and the old complicated tools when new members joined the production group to start producing the stoves:

> **#14824-14829 *Participant SZ:*** *The first action that participants from this community took was mobilising community members to join the production group. Then we met on the 20th with the whole group, both newcomers and old members [who had dropped out]. We encouraged each other and discussed the importance of producing stoves. We also agreed on how to complete the tasks for example collection of clay soil on 22nd. During the same meeting, we nominated a committee responsible only for the production of stoves.* (FUM BK)

> **#14247-14250 *Participant MM:*** *… when we tell them [community members] about the importance of the stove, they feel the agency to join the production group …* (FUM BK)

Apparatus 2- Decision implementation on sub-pathway scarcity of stoves: Participants formed the new production group with 16 new members and 4 old members. They produced approximately 120 stoves in the first cycle, fired and sold them. They also produced the second cycle, which they had mentioned during the follow-up meeting (see also Chapter 7, Section 7.2.6.1). Through decision implementation, participants took consequential actions to change the activity. The excerpts below illustrate this.

Taking consequential actions to change the activity:

> **#14259-14260 *Participant MM:*** *… all the people [who joined the group] are producing stoves and they have produced many stoves.* (FUM BK)

> **#14860-14862 *Participant SZ:*** *By the time we reached the last day on Friday, we had produced more than 100 stoves; now we should have about 120.* (FUM BK)

> **#15084-15086 *Participant MM:*** *Most people only produced 10 or 5 stoves each, but the clay soil was finished before people satisfied their desires. Hence, we have a plan to expand the pit [for fermenting the soil] and collecting more soil. This shows that the activity will continue.* (FUM BK)

Real conflict of stimuli on sub-pathway low stove price: Phase 4a on this sub-pathway occurred with the appearance of the *Field Facilitator AC* during the consolidation session, follow-up workshop 2, specifically when I granted him the floor to respond to participants' requests on stove price increase. Participants wanted to consolidate the rule that producers and community members should be involved in stove price adjustments in order to reflect the general rise of commodities and the hard work involved in stove production:

> **#22705-22707 *Field Facilitator AC:*** *That is what I said earlier that we have a target to rollout two million cook stoves by 2020, so one way to reach the two million target is that people should purchase the stoves, so if we increase the price people would not buy.* (FUW BK2) (See the rest of citation in Chapter 6, Section 6.3.2.9.)

In his response, the Field Facilitator cleared the questions participants had for the entire BCCLWs; however, it reflected the *general structure of coordination.*

The general structure of coordination: The two million cook stove target is the script coordinating the Field Facilitator. However, he kept transitioning towards the general structure of cooperation without critically focusing his attention on the shared object; his focus was on how end-users can access stoves, without considering that the low price was affecting the level of production and uptake in the case study and in fact, the achievement of the two million target. Thus, I can argue that he focused on a partial shared object (see Figure 8.1). The citation (#22705-22707) reflects a conflict of motive similar to the conflict of motives (# 2692-2696, in Session 2).

An attempt to the general structure of cooperation:

> **#22755 & 22757 *Field Facilitator AC:*** *So yes the price is low, I can agree with them.* (FUW BK2)

> **#22730-22733 *Field Facilitator AC:*** *It is possible to raise the price … but people will not buy the stoves, so they [producers] will remain with the stoves. So, which is better to produce the stoves and lack market or to produce and sell.* (FUW BK2)

Participants were requested to wait for the gross margin analysis that would determine a new price for the stove (see Chapter 6, Section 6.3.2.9).

Apparatus 2 – Decision implementation on sub-pathway low stove price: Apparatus 2 occurred long after the completion of the second phase of the study. By the time I conducted follow-up dialogues (FUD), the price had not increased. During the writing of this section on November 3, 2017, I found out from the stove promoter (participant SB) and trainer (participant EJ) on 2 December 2017 in a telephone conversation about the decision. They told me the stove was raised to MWK800 (US$1.12) from MWK600

(US$0.84).[38] They explained that the price was raised in some places such as Balaka and Mulanje, but in some places neighbouring Balaka, such as Liwonde and Machinga, they did not raise the price.

According to *participant EJ,* some time after the completion of follow-up workshops, implementers visited stove production groups and interviewed producers concerning the price issues in relation to cumbersome production processes. Almost a year after follow-up workshops, implementers raised the price of the cook stoves. However, it was difficult to relate conclusively the development to the expansive learning processes because it took place in selected districts. *Participant EJ* explained to me as follows:

> **Researcher:** *Do you think the change occurred because of the deliberations we had during expansive learning processes?*
>
> **Participant EJ:** *It may be possible that it comes from the same deliberations because after that, the organisation [Concern Universal] interviewed stove producers and we were explaining the same issues as deliberated in the meetings (BCCLW). It may be coming from the same or not.* (Telephone interview, 2 December 2017)

Real conflict of stimuli and closure of conditioned connection on sub-pathway cumbersome production process: Phase 4 occurred when participants were given a slot to 'launch the request' (# 8973-8976) at an international forum, the Cleaner Cooking Camp 2016 (see Chapter 5, Section 5.3.2.2) where experts responsible for designing the stove production tools were present. A participant, representing BCCLW participants, presented the contradictions and the modelled solutions to redesign the tools (see Chapter 7, Table 7.2, solution on contradiction number 5).

Another phase 4 was in relation to designating a place for tree planting. However, a place was not designated because participants felt that management would be problematic. Regardless, they planted tree seedlings (see Chapter 7, Section 7.2.6.1). This also illustrates **decision implementation** on this solution. However, the decision on changing tools did not take place because delegates at the Cleaner Cooking Camp 2016 commented that the moulds were recently changed to lessen the pounding that women had complained about and that chances of changing again were unlikely.

Taking consequential actions to change the activity: Participants took actions first by presenting the decisions they made in the BCCLW at the CCC 2016 as indicated above, and second by planting the tree seedlings. The following citation illustrates actions taken on seedlings planting:

> **#14645-14646; 14656-14657 Participant RK:** *… from 145 seedlings, we distributed 5 seedlings to each member … if you go in the homes of these women they would show you where they planted their seedlings.* (FUM BK)

In the following sections, I have summarised the remaining three TAPs as indicated earlier.

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[38] The exchange rate was for 11 November 2017.

8.2.1.3 Transformative Agency Pathway 3: Address delayed cooking on the ICS

The *general conflict of stimuli* is socio-cultural demands *versus* environmental-health concerns (see Chapter 6, Sections 6.3.1.1-6.3.1.3) and socio-economic demands (see Chapter 1, Section 1.7.1.1) *versus* environmental-health concerns. Most families eat one meal a day. Yet they do manual labour in the garden early morning and complete other household chores throughout the day (see Chapter 1, Section 1.7.1.1). Most foods rural women cook on a daily basis take less than an hour to cook on the TSF. However, the women need to save firewood, by cooking on an ICS, because it is scarce (see Chapter 1, Section 1.4.2). Yet the scientific design of the ICS (the need to achieve fuel efficiency) makes the stove slow to heat (see Chapter 6, Section 6.3.1.1). Hence, the *specific conflict of stimuli* is between purchase of an ICS to save firewood *versus* abandoning the ICS, or using it sparingly to satisfy hunger. The conflict of stimuli activates a *conflict of motives* in the women: Cooking on the ICS to save firewood, and delay cooking *versus* cooking on the TSF, consume more firewood and cook faster.

The pathway started in session 1, the *first stimulus* described how end-users are delayed when cooking on the ICS and the reasons why they abandoned the ICS or stack with TSF, vis-a -vis delay in cooking. It triggered several types of transformative agency expressions including *resistance,* in the form of criticism directed at the implementers that they did not sensitise end-users on how to use the stove. This gained *collective agency.* Another *resistance* was in the form of opposition that the ICS does not delay cooking, which also gained *collective agency*. Another expression was *explicating,* that ICS users who use the stove exclusively should share their experiences with those who had abandoned the stove or stack with TSF and learn from them. Further expressions of *envisioning* focused on changing the stove design (see Chapter 7, Table 7.2) and that implementers should be organising community sensitisation meetings on stove handling. The first stimulus also triggered *reflexivity;* a participant questioned whether continuous use of the TSF was progressive and sustainable in light of the scarcity of firewood and the changing environment we are living in and in consideration for the future.

The *second stimulus-first set* was the take-home assignment with the same purpose as discussed in Section 8.2.1.1 (see Appendix 14). However, it did not yield transformative agency expressions. At the end of session 4, I employed *second stimulus-third set.* I gave participants a take-home assignment to stimulate them to understand the problems prioritised and begin to model solutions (see Appendix 14). It triggered different *envisioning* expressions, especially in terms of changing the design of the stove including making a shorter body; this gained *collective agency* (See Chapter 7, Table 7.2 for more examples of *envisioning).* In the expressions of envisioning, 'changing the design of the stove' was an *external stimulus* for making the decision. This is an *auxiliary motive,* phase 3 in apparatus 1. I also identified *implicit committing to take action* to contact and request stove designers to change the stove

design to one which would be faster when cooking. In session 5, a participant expressed *resistance* directed at the interventionist researcher, asking why the stove was advertised as fast and claiming that the researcher needed to verify that the stove delays cooking with evidence from a large sample. However, other participants provided the evidence of the delay (see also Chapter 6, Section 6.3.1.1)

Participants *took concrete actions* to change the activity by preparing action plans (see Appendix 17) and by going to present their request at the CCC 2016. *Phase 4* occurred when participants launched the request to change the stove design at the CCC 2016 to the international experts responsible for designing the stove (see Chapter 7, Section 7.2.6.1). The presentation at CCC was the *implementation of the decision* they formed during the BCCLW. They took steps towards the transformation they needed. However, for this change to take place, more time was needed as explained in Chapter 7, Section 7.2.6.1). This also reflects difficulties to mobilise agency at different levels of the system involving various system boundaries (see Chapter 9, Section 9.3.3). In terms of mode of interaction in this pathway, participants' critical attention was on the shared object because the conflict of motives concerned all the activity systems present. The concerns were directed towards stove designers and implementers who were not available in the BCCLW similar to TAP 1.

8.2.1.4 Transformative Agency Pathway 4: Preserving the stove from cracking on the upper door
The general conflict of stimuli is socio-economic demands *versus* environmental health concerns. The demands to produce low-cost ICS *versus* the demands to satisfy technical requirements and principles of an ICS (see Chapter 1, Section 1.4.3) were pulling in opposite directions. The stove cracked despite following the quality control production process (see Chapter 6, Section 6.3.2.1 and Photo 6.2). However, the cause of the crack was not well established (see Chapter 6, Section 6.3.2.1). The crack created tension between the producers and end-users and it affected uptake and use of the ICS (See Chapter 6, Section 6.3.2.1 and 6.3.2.4). The specific *conflict of stimuli* was the development of the quality control tool to meet quality and ICS standards *versus* creating a cumbersome production process, affecting production of ICS (See Chapter 6, Section 6.3.2.5). The conflict of stimuli activate *conflict of motives* in the subjects of the producer activity system: sell a cracked stove at a normal selling price to compensate for the labour involved in production and make a livelihood *versus* reducing the price to consider the buyer and compromise a livelihood (see Chapter 6, Section 6.3.2.3).

The pathway started in session 1; the *first stimulus* described that the stove cracks at different stages of the production process or after lighting fire. It also described the tension it creates between stove producers and end-users and how it affects both uptake and use of the stove and quality of production (see Chapter, Section 6.3.2.1-6.3.23). This triggered expressions of *envisioning,* a producer suggested

that the interventionist or the implementers should assist in examining the problem in order to deal with the crack. This expression contained an *auxiliary motive:* 'support from interventionist or implementers' as *external stimuli* to solve the problem, through re-examining the production process, conducting research and finding new ways to preserve the crack. This idea gained *collective agency* after employing *second stimulus-first set*. Other types of *envisioning* were that end-users should be sensitised on the crack before they purchase the stove and the clay soil should be sieved to remove foreign materials. The *second stimulus-first set* was the shared object, which I constantly referred to, in order to stimulate participants' thinking during discussion. In addition to expressions of envisioning, participants used *implicit commissive speech acts,* calling fellow participants to think of ways of resolving the problem; this expression gained *collective agency* with another participant calling for working together to resolve the problem. The *second stimulus-second set* was the take-home assignment as indicated in Sections 8.2.1.3 with the same purpose. It triggered *envisioning* in session 3, in the form of changing the stove construction tools, such as the mould with already-made door (see Chapter 7, Table 7.2). At the end of session 4, I employed the *second stimulus-third set*, a take-home assignment to stimulate participants to understand the problems prioritised and begin to model solutions (see Appendix 14). This yielded *envisioning* during examination of solutions in Session 5 (see Chapter 7, Table 7.2). *Phase 4* in this TAP occurred with the presentation of the contradictions and modelled solutions at the Cleaner Cooking Camp 2016, as indicated in Section 8.2.1.3. At the same time, it characterized *decision implementation,* as participants had planned during BCCLW. Participants *took actions* when they prepared action plans (see Appendix 17) and executed the plans. Similar to Section 8.2.1.3, the TAP was opened, but implementation did not take place (See Chapter 7, Section 7.2.6.1 and Chapter 9, Figure 9.1).

In this TAP, I did not identify any quotes that I could use to characterise the mode of collaboration among participants. However, participants collaborated on finding solutions to the problem. They had an understanding between them that the activity systems available during the BCCLW could not solve the problem because they did not understand the cause of the crack; hence deliberations were mostly directed towards stove designers and implementers, despite that, at the beginning, participants felt that producers were responsible.

8.2.1.5 Transformative Agency Pathway 5: Putting the end-user in the centre from periphery
The *general conflict of stimuli* is top-down models and assumptions around socio-technical innovation implementation and adoption *versus* environmental-health concerns (see Chapter 2, Section 2.6.1). The *specific conflict of stimuli* is between expecting the potential user to save firewood and prevent indoor air pollution by using the ICS *versus* putting the end-user in the periphery of sensitisation messages of the ICS (see Chapter 6, Section 6.3.3.1). The conflict of stimuli activates a *conflict of motives* in the end-

users: Use the ICS to save firewood *versus* abandoning the stove due incorrect use and consume firewood on TSF (see Chapter 6, Section 6.3.3.1).

The TAP started in Session 2, the *first stimulus* described absence of sensitisation meetings in the community and that the end-user was asked to buy the stove without any messages about the purpose, importance and handling of the stove, yet they are told that they will be given an incentive. It highlighted problems with interaction among actors that the end-user received no messages because the interaction existing between the end-user and producer is only a business transaction (see Chapter 6, Sections 6.3.3.1 and 6.3.3.2). This triggered expression of *envisioning* a new model in which producers are involved in sensitising end-users on purpose, importance and handling of the ICS, and suggested a neat collaboration and interaction among implementers, promoters, producers and end-users. Then, I employed the triangle model as a *second stimulus-first set* to stimulate participants to identify the origins of the problem in the activity system. This triggered *reflection on the practice* on the way the roles are divided between the interacting activity systems (see Chapter 5, Section 5.2.1). The participant explained that it would be problematic in the future to sensitise users when the project would phase out, and *envisioned* that the project implementers should give producers the mandate to sensitise end-users and promote the stove. Another participant *explicated* and *envisioned* that promoters should continue sensitising the community about the stove whenever there was a community development meeting (see Chapter 7, Table 7.2). This idea gained *collective agency.* Another participant *voiced power relations*, recognising limitations in organising community meetings on their own without collaboration with promoters and implementers if the meetings have to make impact.

The *second stimulus-second set* was the take-home assignment with a similar purpose as explained in sections above. In Session 3, it triggered *envisioning,* suggesting that meetings for end-users are important to sensitise them on stove handling. The 'meeting' is the *external stimulus* that the participant brings in to solve the problem. This is the *auxiliary motive* phase. The idea gained *collective agency* in this and subsequent sessions. In addition, another user *explicated* how end-users are sensitised through community development meetings around where she lived and how Village Development Committee members take part in the dissemination process. Other participants used *implicit commissive speech acts* to call fellow participants to find other solutions to the problem because the community development meetings were not adequate in sensitising people on ICS. Then participants expressed *envisioning* suggesting 'learning forums' for only women to constantly meet and talk about the stove; community meetings should be organised specifically for discussing the stove and producers should be given the mandate to promote the stove and sensitise users (see also Chapter 7, Table 7.2).

At the end of session 4, I employed the *second stimulus-third set*, a take-home assignment to stimulate participants to understand the problems prioritised and begin to model solutions (see Appendix 14). This triggered *envisioning* in session 5, reflecting *collective agency* on the need to organise meetings with end-users. Another envisioning was to increase the number of promoters. I identified other expressions of *envisioning* during modelling solutions (see Chapter 7, Table 7.2). Furthermore, producers expressed *implicit committing to actions* in organising meetings in the communities if implementers and promoters can initiate the process. In session 7, another participant *committed to taking actions* to organise meetings by explaining the order of tasks to be completed in order to organise community meetings. Participants also *took actions to change the activity* by preparing action plans (see Appendix 17) and *implemented the decisions*. They organised the meetings and learning forums where people were sensitised about the stove (see Chapter 7, Section 7.2.6.1). In this pathway, participants collaborated to find solutions to the problem. Most of the issues deliberated were directed towards implementers and promoters. However, all participants' critical attention was on the shared object.

8.2.1.6 Reflective Talk: Learning from the expansive learning processes and the practice

Within the pathways discussed, I did not identify reflective talk that indicated that participants 'had learnt from the practice and would use it to transform the practice'. The type identified was 'examining one's own practice in order to change it'. Reflective talk indicating that participants had learnt from practice was common during follow-up workshop 1, which I specifically organised for participants to reflect on the expansive learning process (see Chapter 7, Section 7.2.6.3). The following were some categories from the reflection process:

Learning from the expansive learning actions:

> **#17020-17023 *Participant SB:*** *… I have learnt that most of the times we should not follow one person's ideas; experimenting helps. If we had believed that the soil is not good, let us just leave it, we could have lost this opportunity.* (FUW BK1)

The participant indicated that she had learnt that experimenting with things and especially problematic situations is important in the continuation of an activity. This kind of reflective talk can enhance individual agency.

> **#17713-17721 *Participant SZ***: *We have started our [expansive] process well because we have been discussing that the production process is hard because of the production tools are heavy. We tried to discuss on how we can reduce the burden by finding lighter tools and machine for smoothening soil. I think that we have approached the process well because we experimented to consult the stove and tool designers. Even though they said it would take long to change, but we feel that we have a brighter future because we have prospects for lighter production tools and that in future we would produce many stoves in a short period.* (FUW BK1)

> **#17292-17294 *Participant RK:*** *What I have learnt from this [learning] process is collaboration among us …* (FUW BK1)

Participant SZ acknowledged the importance of the expansive learning process in understanding the problems and modelling the solutions. She underlined the importance of experimentation as a step towards transformation in the activity, particularly in providing the members prospects for a better production process. On the other hand, *Participant RK* underlined the importance of the expansive learning in bringing people to work together.

> **#17034-17041 *Participant SB:*** *The first thing I can tell someone is that when we started our learning process, our activity had many problems, but now some of the problems are being reduced as we go along. For example, we found that end-users were not using the stove because they did not receive sensitization messages and they may have had experienced problems on how to use the stove. Now, because we experimented with conducting meetings, some people who never used the stove have already started using the stove.* (FUW BK1)

Participant SB (#17034-17041) recognised the importance of the expansive learning process in reducing some of the many problems the activity had at the beginning of the process. She also foregrounded the idea of experimentation, specifically sensitisation meetings that participants conducted that transformed the practice, as some people had started using the stove.

Learning for sustainability of practice: Participants learnt that problems could be solved through discussion in order to sustain an activity. In addition, they learnt the importance of looking into the future when solving problems so that they are able to make good progress in an activity. They also learnt how to examine problems from different angles in order to sustain an activity. The following citations illustrate this:

> **#17794-17796 *Participant SZ:*** *I have learnt that when we have problem we need to persevere, sit down and discuss, and find ways for addressing the problem at hand, so that our activity can be sustainable.* (FUW BK1)

> **#18030-18031 *Participant EC:*** *I have learnt that we need to look into the future before we start solving a problem, we need to examine that, when I solve the problem this way, how will I progress.* (FUW BK1)

> **#18038-18044 *Participant R1:*** *I have learnt that when we solve problems we should not look at one angle, we instead look at all the angles. For example … we concentrated more on making the stove available for use, we did not focus on marketing. … so we need to examine all angles depending on the objective we would like to achieve.* (FUW BK1)

> **#18127 *Participant FK:*** *I have learnt that we should look into the future [when solving problems in our activities].* (FUW BK1)

Learning is continuous: Participants also learnt that there is always a possibility to solve problems through learning because learning is an ongoing activity, hence problems should not discourage us and every time we encounter problems, we will learn new ways of solving the problems:

> **#18099 *Participant RK:*** *I have learnt that learning is continuous.* (FUW BK1)

#17790-17792 Participant FK: *I have learnt that we should not be discouraged in our activity whenever anything happens [when we encounter a problem], but we should continue working so that we should achieve our objectives.* (FUW BK1)

8.2.2 Waziloya Makwakwa Village case study

8.2.2.1 Transformative Agency Pathway 1: Heat regulation for convenient cooking

Apparatus 1: Decision forming

Conflict of stimuli: The *general conflict of stimuli* is socio-cultural demands *versus* environmental-health demands (see Chapter 6, Section 6.4.3.1 and 6.4.3.2). The socio-cultural demands of a woman to take care of the family, feed the husband in time and complete several household chores while responding to environmental health concerns generate a *specific conflict of stimuli*: spending more time looking after a pot on the ICS to avoid burning foodstuffs and pots *versus* saving firewood. This conflict of stimuli activated a conflict of motives:

Conflict of motives: Saving firewood *versus* completing other domestic chores. The woman is caught in a conflict of motives: she cannot save firewood at the same time complete other domestic chores because she may burn the food and the pot. In order to save the firewood, other domestic chores have to wait until cooking is complete.

First stimulus: The *first stimulus* was the presentation of excerpts from interviews during Session 2 of BCCLW. It described how food and pots burn on the stove regardless of having enough water in the pot, and removing firewood to reduce the level of fire and that when the woman goes to attend to some other household chores, they often return to find the pot scorched (see Chapter 6, Sections 6.4.3.1; 6.4.3.2). The first stimulus generated expressions of transformative agency:

Resistance: Participants expressed resistance, indicating that scorching occurs when one neglects the pot. The following citations illustrate this:

> **#1967-1970 Participant CB:** *No. This happens even on the TSF. If the beans are cooked and you put water and more fire then they scorch because they form thick sauce underneath the pot. Which means if you put more fire then you exceed the limit. Not that the stove in Waziloya is scorching things, no.* (BCCLW MZ2)
>
> **Researcher:** *But this came from the people I interviewed.*
>
> **#1973 Participant CB:** *Maybe they were appreciating that the food is cooked fast.* (BCCLW MZ2)
>
> **#2030 Participant MP:** *The problem is that they put too much firewood and the fire is too much.* (BCCLW MZ2)
>
> **#2032-2033 Participant MP:** *… when you put too much fire on the TSF it scorches food in the same way if you put too much fire on the stove it scorches food.* (BCCLW MZ2)

Participants **collectively** resisted the conflict of motives. In response to *participant MP* (#2030; #2032-2033), I explicated the problem as follows:

> **Researcher:** *If people put a lot of firewood [on the ICS], then it is a problem. It means people do not know how the stove performs because they are used to putting may be eight pieces of firewood on the TSF and you tell them to put one piece of wood on the stove, it means that people do not know how to use the stove that it why the food scorches.*

This triggered more expression of 'resistance' from the implementers[39] in the form of 'criticising' stove constructors:

> **#2048-2053 Participant FC:** *That is a problem because those of us leading this work should stop going with construction materials and start stove construction without teaching the potential user how to use the stove … Many times, we just construct many stoves and leave.* (BCCLW MZ2)

In the same speech, (#2049-2051) *participant FC* characterised the problematic object as a source of new possibilities for stove constructors to take up the role of sensitising potential users. Then he 'implicitly commits to taking action', to find a solution to the problem:

Explicating new possibilities:

> **#2049-2051 Participant FC:** *… we should start teaching the user about the importance of the stove, so that she should know that when I do this, this would happen.* (BCCLW MZ2)

Implicit commitment to taking action:

> **#2053-2054 Participant FC:** *… This is very important. Therefore, we need to acknowledge that this as a problem so that we can find a way of resolving it. …* (BCCLW MZ2)

An attempt at the general structure of cooperation: I traced a shift towards *cooperation* in participant FC's speech (#2049-2051; #2053-2054). He focused his attention on the shared problem, to find ways of resolving it. However, in my intention to verify if this was a general problem in the community, I summarised participants' views. This triggered 'resistance' from participant FC in the form of 'opposing the interventionist's interpretation of the problem'.

Resistance:

> **Researcher:** *… But the problem is that we do not have a mechanism to regulate the temperature on the stove … even when we remove the firewood; it is possible that the heat exceeds the requirements and scorches pots and food.*

> **#2168-2170 Participant FC:** *What you have explained is well understood. But for me I think the problem is not that the user is negligent, but the user did not understand the concept behind the stove. But I refuse that the problem is coming from heat from the stove, no.* (BCCLW MZ2)

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[39] Implementers are the two Field Facilitators: participant FC and Participant AK. I identify them interchangeably in the discussion to emphasise the point of views in specific contexts. Participant CB is the chairperson of CADECOM project in the community.

The interpretation that the user did not understand the concept behind the stove (#2168-2170) gained *collective agency:*

> **#2182 *Participant DC:*** *I think that the user has not understood how to use the stove.* (BCCLW MZ2)
>
> **#2193-2195 *Participant MN:*** *It is a problem because … we do not know how to use – how to put the firewood. … The problem is failure to understand the level [of heat] required.* (BCCLW MZ2)

Second stimulus-first set: At this point I introduced the triangular model (see also Chapter 7, Section 7.3.2). The purpose was to help the participants locate the origin of the problem from the elements of the activity system, to facilitate in the analysis of the problem and in preparation for modelling solutions. Participants located the problem as the subject of the activity system including the user, and the people responsible for sensitising the users – the community (implementers and stove constructors) (see Chapter 5, Figure 5.11). The presentation of the second stimulus triggered 'envisioning' in the form of preliminary suggestions on how to sensitise users.

Envisioning:

> **#2545-2546 *Participant CB:*** *What is needed is that we the people responsible for promotion should sensitise the users about the amount of firewood they should put (on the stove).* (BCCLW MZ2)
>
> **#2565-2566 *Participant CB:*** *The subject (end-user) should also take interest so that the people sensitizing should perform the work efficiently.* (BCCLW MZ2)

Second stimuli-second set: I introduced the second set of second stimuli, the take-home assignment between session 2 and 3 (see Appendix 14). The main purpose was for participants to collect more views from community members to understand the extent of the problem. In session 3 when participants discussed the root causes of the problematic situations from the take-home assignment, the Field Facilitators ***collectively*** expressed 'resistance' in the form of 'criticism' directed at the stove constructors and the end-users. In addition, I traced the '*general structure of coordination*.'

> ***Researcher:*** *So my question is, why don't end-users understand properly the concept behind the stove?*
>
> **#4274-4275 *Participant FC:*** *It is because implementers disseminated the message, but the stove constructors removed some of the message.* (BCCLW MZ3)
>
> **#4295-4296 *Participant AK:*** *The implementers disseminated the message properly, the stove constructors also built the stoves properly, but the end-users did not follow the implementers and constructors' instructions.* (BCCLW MZ3)

The general structure of coordination: The Field Facilitators' (#4272-4275; #4295-4296) critical attention was on their role as implementers of the ICS. They did not question what happened for the stove constructors to remove some of the message or why the end-users did not follow the implementers'

instructions. After some debates from the different activity systems, implementers reflected on the implementation of the ICS practice, indicating lessons learnt from the expansive learning process:

Reflective Talk: Learning from the expansive learning processes and the ICS practice:

> **#4367-4370 *Participant FC:*** *The truth is, on our side, since we started this research; it has shown us that we have information gaps. One such information gap is that we are not fully cognisant of the amount and sizes of firewood required, we are not cognizant.* (BCCLW MZ3)

In #4367-4370 *participant FC* indicated that he has learnt something from the expansive learning process that may help to change the ICS practice if taken up. However, another expression of 'resistance' followed:

Resistance:

> **Researcher:** *… now here the findings indicate that the problem is that they put a lot of firewood, which means that the person does not know how to use the stove. Now, the question is did the end-users receive the message that the stove was designed to be hot … and that … you can cook without firewood, when it becomes hot?*

> **#4290-4394 *Participant FC:*** *Two things, first we need to understand that change does not happen at one time. These people have been using the TSF, which requires that when firewood is finished, you put more. But this stove is not easy because it has instructions.* (BCCLW MZ2)

This expression of resistance was followed by reflexivity. The Field Facilitators reflected on how they sensitise potential end-users, which could help in understanding the problematic situation and changing the practice because they realized that sensitisation was an ongoing activity:

Reflective Talk: Ability to look into oneself:

> **Researcher:** *So should we say that the problem is originating from the fact that people are not used to the stove or they do not know because they were not sensitized properly?*

> **#4415-4418; 4420-4421 *Participant FC:*** *… the thing is we sometimes – at the beginning we were sensitising properly, then at some point we felt that people now are aware, and we were just constructing stoves without sensitising the people thinking that they all know. But sensitisation should be an ongoing activity ..]. So that people should understand completely.* (BCCLW MZ3)

The reflective talk gained ***collective support*** from another Field Facilitator:

> **#4426-4427; #4429; 4431 *Participant AK:*** *… after that the stove constructors may only explain to one person and think that sensitization is over … so new potential end-users … are not aware of what happens and how it happens.* (BCCLW MZ3)

Reflective talk: Learning from Expansive Learning processes:

> **#4448-4451 *Participant AK:*** *Similarly, with this research – about the stove design, when I went back home the day before yesterday, it is when I completely understood, because I did not know that we need this here and we need this there. But when I was here, the message was not clear. I did not understand completely.* (BCCLW MZ3)

In #4448-4451, the participant echoed that learning was an ongoing activity, which needs constant reflecting and interaction. The interaction he had in the previous session helped him to reflect on the stove design and identified the gaps.

Auxiliary motive: After some discussions on the causes of the problematic situation participants appeared to be unsure about the probable cause. This led one participant to introduce the idea of 'experimentation' as an **external stimulus** to help make a decision to resolve the conflict of motives; *Phase 3 in Apparatus 1*. He expressed this through 'explicating new possibilities' in the activity and 'envisioning'.

Explicating new possibilities and envisioning:

> **#4535-4536 Participant DM:** *… we need to try with one stove. As we go along, we should construct one stove with half measurement of cow dung. …* (BCCLW MZ3)

This idea gained **collective agency** in #4615. However, the suggestion was resisted by the Field Facilitator (#4622):

> **#4615 Participant CB:** *We should reduce [the amount of] cow dung.* (BCCLW MZ3)

Resistance:

> **#4622-4623 Participant FC:** *… but to say that [the amount of] cow dung is causing pots to scorch – it will be difficult to provide evidence.* (BCCLW MZ3)

After some deliberations with suggestions from participants that there could be a possibility that the measurement for cow dung exceeds the required amounts and it maybe a probable cause for pot burning, the Field Facilitator expressed 'committing to taking actions'.

Committing to taking concrete actions:

> **#4678-4681 Participant FC:** *So what we need to do is to work with the person, and when she has grasped the concept, and the stove is no longer scorching pots, then the measurement [referring to cow dung] is appropriate. But if after the person has grasped it and the stove still scorches pots then we will experiment with the cow dung [reducing cow dung].* (BCCLW MZ3)

With this commitment (#4678-4681), the idea of experimenting with reduced amount of cow dung gained **collective agency** (from #4535-4536). Additionally, I traced the general structure of cooperation (#4678-4681). The participant's critical attention was to try to find mutually acceptable ways by committing to experiment with both problematic situations successively.

Participants expressed 'envisioning' and 'implicit commitment to taking actions' when explaining other probable ways of resolving the conflict of motives. The expressions of transformative agency from participants collectively supported changing the stove design, regarding measurements. With these agentic expressions, the idea of using 'experimentation' (with different aspects of the stove) to make a decision gained **collective agency.**

Envisioning:

> **#4885-4889 *Participant CB:*** *… the banana tree trunks for making holes inside to distribute fire are very small, yet the hole that comes with fire is big. So can fire go on the sides with much power? It stays on the centre that makes the pot on the centre only to burn. So we need to change the size to bigger ones to ensure good distribution of fire.* (BCCLW MZ3)

Implicit commitment to taking actions:

> **#4932-4933 *Participant FC:*** *… So when we reach modeling of solutions stage we need to include that we should make a stove which has specific height …* (BCCLW MZ3)

Second stimuli-third set: The third set of second stimuli was the triangular model that I presented in session 4 to help participants locate the sources of the problems in different elements of the activity system, and the interaction between them. This triggered 'implicit commitment to taking actions'.

Implicit committing to taking actions:

> **#6574-6575 *Participant FC:*** *We need to be prepared that when we resolve one problem, something else changes [referring to changes in measurements].* (BCCLW MZ4)

The expression of agency in #6574-6575 indicates that the participant implicitly called for fellow participants to implement the decisions formulated.

In session 5 during modelling solutions, participants expressed 'envisioning' in relation to the nature of the learning action, plus 'commitment to taking actions'. The suggestions were reported from the take-home assignment, the second stimulus-second set. I highlight a few that informed decision implementation.

Envisioning and committing to taking actions:

> **#7481-7482 *Participant CB:*** *… the important thing is that we should come up with a way to make the stove produce the required heat.* (BCCLW MZ5)

> **#7544 *Participant DM:*** *We need to increase the size of [the fire distribution] holes inside.* (BCCLW MZ5)

> **#7559-7561 *Participant DM:*** *… this one we will experiment – to reduce the amount of cow dung to half of a pail in order to reduce the heat on the middle cooking place.* (BCCLW MZ5)

Increasing the size of holes inside the stove (#7544) gained **collective agency** from session 3 (#4885-4889). Similarly, the reduction of cow dung (#7559-7561) from session 3 (#4535-4536; 4678-4681). *Participant DM* (#7559-7561) also expressed 'commitment to taking actions' through experimentation.

In session 6 at the end of examining solutions, participants expressed that they had learnt from the expansive learning process on how to examine an activity; they indicated that what they had learnt would be used to change the practice:

Reflective talk: Learning from Expansive Learning processes to examine one's practice in order to change it:

> **#9130-9140 *Participant FC:*** *… we lived in problems. But when you examine the problem, the solution is right behind it. This should be a lesson in our lives that every problem we encounter should be a guide to finding solutions. When we have problems, we will not watch. … through our collaboration we have managed to find solutions – the solutions did not come from outside. We need to know that every problem has a solution, but most importantly that when you have a problem and use proper ways, even if it takes long, the solution will be suitable and sustainable.* (BCCLW MZ6)

> **#9152-9153 *Participant FC***: *We need to put this in our minds that learning is the foundation of everything, and lack of knowledge is a foundation to failure.* (BCCLW MZ6)

> **#9154 *Participant AK:*** *This means that lack of knowledge is a foundation to failure of development.* (BCCLW MZ6)

> **#9156-9158 *Participant MN***: *… we thought that you will provide us with guidelines to follow but it's the questions that you were asking, the answers we were providing and the problems we had that have given us the solutions. … now our minds are open, we know where we are going and what to do.* (BCCLW MZ6)

Participant FC (#9130-9140) referred to the expansive learning process as a proper yet long process to finding suitable and sustainable solutions. He also acknowledged the importance of collaboration in finding new ways of working and the power of learning and knowledge gained through the expansive learning process (# 9152-9153). *Participant AK* linked knowledge and development. This echoes Vygotsky's (1978) seminal findings that learning leads to development (p.90) (see Chapter 3, Sections, 3.2.1). Similarly, *Participant MN* (#9156-9158) commented on the expansive learning and the role of the interventionist researcher in aiding the learning process through questions, rather than providing participants with answers and how this has provided them with ideas on how to carry on with the activity.

In session 7, participants expressed 'committing to taking concrete actions' by describing the steps to take during experimentation with heat regulation.

Committing to taking concrete actions:

> **#11881-11885; #11890-11893 *Participant FC:*** *What we are going to do … after the stove has cooled down …, we will make fire, note the time it will take to heat …, remove firewood, then put a pot, note how long the pot will boil after removing the firewood … and when it would stop boiling…* (BCCLW MZ7)

Participants also 'committed to taking actions' through the development of action plans to execute the decisions formulated.

Real Conflict of stimuli and closure of conditioned connection: Phase 4a and 4b occurred during experimentation phase of the expansive learning cycle between the last session of BBCLW and follow-up workshops (see Appendix 11). Participants identified a bigger size of banana trunk for making holes

and collected 10-litre pail (half measurement) of cow dung. They collected all stove construction materials and identified a kitchen for stove construction. Participants mixed the 10 litres of cow dung with the rest of the materials and placed the bigger size of banana trunk at the site of stove construction.

Apparatus 2-Decision implementation: Participants constructed a stove with enlarged fire distribution holes and 10 litres of cow dung (see Chapter 7, Table 7.9, stove 1 and Photo 7.10).

Taking consequential actions to change the activity: With the implementation of the decisions, participants took consequential actions to change the activity. The citations below illustrate this:

> ***#15571; #15574-15575 Participant CB:*** *… because of enlarged holes, the food from all three places get cooked at the same time … Since we learnt how to construct the stove with enlarged holes everything is ready at the same time.* (FUW MZ1)

> ***#15621-15622 Participant MN:*** *The good thing about enlarging holes is that now the pot on the middle does not scorch anymore because it is receiving the required heat since the fire is well distributed.* (FUW MZ1)

Participant CB and MN (#15571; #15574-15575; #15621-15622) indicated that they had constructed stoves with enlarged holes and had experimented with them. See also Chapter 7, Section 7.3.6.1, for more evidence on this and for stoves constructed with 10 litres of cow dung.

8.2.2.2 Transformative Agency Pathway 2: Stove construction as source of livelihood and managing group activity

Apparatus 1: Decision forming

Conflict of stimuli: The *general conflict of stimuli* is the demands emanating from socio-economic situation of the women involved in stove construction *versus* environmental-health concerns. This general conflict of stimuli generated a *specific conflict of stimuli* to provide for the needs of the family members and stove construction activities *versus* to provide free stove construction to the rural poor to save firewood and prevent indoor air pollution. (See Chapter 6, Sections 6.4.4.1; 6.4.4.2; 6.4.4.3.) The conflict of stimuli activated conflicts of motives:

Conflict of motives: The first conflict of motives was constructing stoves for people who did not attend CADECOM project meetings and for people outside the project area and charging a fee *versus* rejecting the request from the two groups and denying them the benefit of having a stove to protect the environment. The second conflict of motives was to do the work as skilled volunteers, with no means to generate income *versus* to generate income out of the expertise they had acquired from stove construction as a source of a livelihood and for supporting stove construction activities (see Chapter 6, Section 6.4.4).

First stimulus: During BCCLWs, the first stimulus was the presentation of excerpts from interviews. The excerpts described how participants felt that they did not realise profits from stove construction. It also described how participants needed to make a livelihood out of stove construction; at the same time how problematic it was to ignore others who need the stove, yet how difficult it was to construct stoves for them because it was free. At the same time, they had a feeling that they were not utilising the expertise they had in stove construction (see Chapter 6, Section 6.4.4.). In particular, the first stimulus highlighted the conflict of motives confronting members of the stove construction group. After participants made sense of the conflict of motives, a Field Facilitator expressed 'resistance' in the form of criticism and opposition.

Resistance:

> **#1397-1405 *Participant FC:*** *The problem is that the people constructing the stoves did not grasp the objective of constructing stoves in the first place. It could have made sense if the stove project came as a business or if it meant that, the voluntary work would involve charging a little fee. However, it came as development. Those involved were those who had displayed expertise in the work and later on when they saw that they had the expertise, they started thinking of personal benefits and development. … Yet their benefit is when they construct many stoves.* (BCCLW MZ2)

> **#1434-1437 *Participants FC:*** *Moreover, we want that people should understand this development and take the ownership because that would facilitate use of the stove. If we just build them [potential users] stoves and charge, they would not use the stove because they may not have grasped the purpose of the stove.* (BCCLW MZ2)

In the excerpt above (#1397-1405), *participant FC* started with criticising the stove constructors for not grasping the objective for stove construction. He then opposed the idea of charging for stove construction, arguing that they initiated the project as a free developmental activity. He then argued that charging for the stove would contradict the principles of ownership as envisaged from the project (#1434-1437).

This resistance gains ***collective support*** from another Field Facilitator, who argued that charging for the stove construction would scale down stove uptake:

> **#1441-1443 *Participant AK:*** *I think that if we start talking about charging money it would reduce the number of stoves greatly because people will be reluctant to build since they would say they demand money to build stoves and I do not have money.* (BCCLW MZ2)

In the citations (#1434-1437; #1441-1443), the mode of interaction was within the ***general structure of coordination***. The Field Facilitators focused on their roles as implementers. The scripts coordinating them were first the need to scale up ICS to reach the targeted figures (see Chapter 6, Section 6.4.4.3). Second, they needed to ensure potential users' ownership, which they argued might facilitate use. Yet they did this without questioning how the free stove construction was affecting uptake for those who were apathetic due to the scarcity of stove construction materials (See Chapter 6, Sections 6.4.2.1-6.4.2.3) and how it affected the constructors and the spreading of the socio-technical innovation (see Chapter 6,

Section 6.4.4.3), both within and outside the project area. It is worth noting that the areas outside the project area also relied on the mountain forest as a source of firewood (see Chapter 1, Section 1.7.2.2). However, stove constructors felt that a new model could be implemented. One stove constructor expressed envisioning in the form of a preliminary suggestion on how the charging could be done:

Envisioning:

> **#1446-1456 *Participant MN***: *My thinking is that because some people cannot manage to collect all the stove construction materials, and the construction group cannot collect the construction materials for potential users, if a person comes to approach us that "I want the stove but I cannot manage to collect all the materials alone, but I will give you a little money when you construct", could be a good development. … It is because some people are lazy (apathetic) to collect ndhulani, grass, this and that. They are also afraid of cob mixing. But if the person says I will give you a little money, the group can get organised and construct the stove for her.* (BCCLW MZ2)

The *participant MN*'s suggestion was a reaction to the Field Facilitators' resistance (#1434-1437; #1441-1443,). Her suggestion indicated that the ownership would not be affected because the demand would come from the potential user; moreover, it might scale up uptake because it would create an alternative for the apathetic potential users. Another participant, the Chairperson of the CADECOM project in the community, also expressed 'resisting' in support of the Field Facilitator's opposition (#1434-*1437;* #1441-1443).

Resistance:

> **#1458-1460 *Participant CB****: I also think that charging would lead to regression of the development because what we want is to protect the environment …* (BCCLW MZ2)

The idea that charging for stove construction would scale down stove uptake because people may not have money to pay, especially also because the project was free initially and that changing the model may confuse the community, gained **collective support.** However, *participant FC* expressed envisioning in the form of a preliminary suggestion on how the constructors could charge, followed by an attempt at the 'general structure of cooperation'.

Envisioning:

> **#1500-1504 *Participant FC*** *… If it is outside Ehlonipeni area and people have called them [constructors] to assist them, that would not be a problem, it also would spread the development. After all that would be outside our project area. Even if people would ask you to teach them the technology outside the project area, you are free to ask them for money since you would be coming from far. But in our project area, it is free.* (BCCLW MZ2)

An attempt at the general structure of cooperation:

> **#1528-1529 *Participant FC:*** *Like I have said, I don't have any problem with the fact that they should charge, but now the message [that the project is free] was already spread, so then the issue is what do we do to make sure things progress smoothly? …* (BCCLW MZ2)

Participant FC attempted cooperation by 'implicitly suggesting' that they need to think of ways to solve the problem (#1528-1529): "make sure things progress smoothly". He continued with 'envisioning' suggesting that they needed to start again the process of explaining to the community if they started charging for stove construction.

Envisioning:

> **#1534-1537 *Participant FC:*** *When they now say that they [stove constructors] need money, we really need to think deeply since we are only the representatives of stove constructors from Ehlonipeni, we need the whole group, sit down together and start again [to explain things].* (BCCLW MZ2)

Participant FC expressed another envisioning when I needed clarification from participants as to if they felt that the first stimulus revealed a problem that could constrain the achievement of the shared object.

Envisioning:

> **#1547-1553 *Participant FC:*** *The problem is that the people who mastered stove construction are few but there is a lot of work … now we need to find a way to solve the problem. What is needed is that for example [names of people], each has a club, and then there has to be other people who should also master stove construction to help them. Then as they go along the clubs will have many people …*(BCCLW MZ2)

As the discussion went on, I needed to understand why participants were opposing the stove constructors' suggestion put forward in the citations (first stimulus) and alluded to in #1446-1456. The suggestion was that if they would charge for the stove, the constructors could collect all the materials and construct the stove for the potential member.

> **Researcher:** *Now, you expect that one person should manage to collect all the materials, yet you think that it would be difficult for four or five people to collect for one stove, why is that?*

The response to the question indicated the general structure of coordination. The participant expressed that the problem with charging for the stove would contradict with the lessons learned from the implementers:

> **#1601-1602 *Participant CB:*** *The people can manage to collect the materials but then that would mean that we are demeaning the lessons we learnt for progression of development in our community and protecting the environment.* (BCCLW MZ2)

Participant CB was echoing the issues raised earlier (#1434-1437, #1441-1443, #1458-1460). The lessons learnt (#1434-1437) were the script coordinating the participant's actions. However, at the end she explained that charging would be problematic because of the poverty in the community. Then she made an attempt at *cooperation* with a rhetorical question:

An attempt at the general structure of cooperation:

> **#1606 *Participant CB:*** *What I wanted was that, as we have gathered here we should now discuss- what are we going to do about this?* (BCCLW MZ2)

In #1606, the participant was suggesting that during the BCCLW deliberations they should find mutually acceptable ways to solve the problem.

Confronting and navigating power relations: Following the general structure of cooperation, a stove constructor confronted, navigated power relations and voiced out the power stove constructors have (see Chapter 6, Section 6.4.4.3, *participant DC*). This expression gained **collective agency** from another stove constructor:

> **#1634-1639 *Participant MN:*** *Many people approach us, requesting us to build stoves for them … Because of that, we felt that if we can organise ourselves we could go to construct them stoves and find some little money, because many people request us.* (BCCLW MZ2)

The stove constructors' voiced out the power they had, gained from the expertise obtained from the training they had in stove construction. They would have liked to use it to scale-up stove uptake while benefiting personally and as a group. Additionally, *participant MN* supported the suggestion from *participant FC* (# 1500-1504). The suggestion gained **collective agency**:

Envisioning:

> **#1641-1645 *Participant MN:*** *As [name of person] has indicated, to ensure that many people learn the technology in other areas, it requires that some people go in those areas and teach the people. I think that in so doing they would understand that, since these people come from far just to teach us it is not free. In that way, we are going to make a little money.* (BCCLW MZ2)

In the citations from *Participant DC* (see Chapter 6, Section 6.4.4.3) and *participant MN* (#1634-1639; #1641-1645), I traced an attempt at '*reflexive communication'*. They reconceptualised the shared object, vis-a-vis to scale-up stove uptake which might help meet the implementers' targeted figure and facilitate protection of the environment. They conceptualised the script by giving the potential users who could afford it, an alternative to pay for stove construction, which would ensure ownership. In this way, development has been conceptualised as 'not free'. However, the interaction between the actors, especially the implementers and the stove constructors, was not conceptualised (see Figure 8.2). Participants were divided, with implementers continuing to resist the suggestion to provide the alternative to pay for the stove for those who could afford it, especially those within the project area and those who were members of the CADECOM project. I provide one illustration.

Resistance:

> **#1677-1680 *Participant AK:*** *In the village Waziloya, we have two groups of people some they do not want to participate in CADECOM project activities. For those ones, they can pay if they want a stove, but we will not accept members of the CADECOM project to pay money.* (BCCLW MZ2)

Second Stimuli-first set: The first set of second stimuli was a sketchy diagram, explicating different scenarios on how the activity was organised and could be organised by highlighting the alternatives that constructors suggested. This triggered 'resistance' expression directed at the interventionist researcher:

> *Researcher: We have two alternatives. The first scenario is free no matter what.*

Before I completed explaining the second scenario, a Field Facilitator expressed 'resistance':

> **#1685 *Participant AK:*** *Just like this learning process is free.* (BCCLW MZ2)

Participant AK resisted the idea of charging a little money to help participants resolve the conflict of motives confronting stove constructors. He implicitly told the interventionist researcher that she was doing the same thing that they were doing with the project by providing free learning activities (BCCLWs). However, after explaining the two scenarios, indicating that ownership would not be compromised in both scenarios, the implementers indicated that the suggested alternative could be taken up and that there was no problem implementing it in the project area because it would be on request from potential users. They did this through 'explicating' by relating to how other activities in the community are conducted.

Explicating:

> **#1705-1706 *Participant FC:*** *Even in the project area because it is the same as hiring someone for piecework.* (BCCLW MZ2)

> **#1706-1707 *Participant AK:*** *It is the same as giving them [community members] maize seeds and they take it to pay for those who have worked in their gardens, no problem.* (BCCLW MZ2)

At this point, I needed to be clear whether participants felt that this conflict of motives should be endorsed and carried forward to resolve it. However, the implementers expressed 'resistance' and 'commitment 'not' to take action' because they were afraid that the change might confuse community members (see also Chapter 7, Section 7.3.3).

Resistance and committing 'not' to take action:

> **#1757-1760 *Participant FC:*** *That should not be written as a problem because … this activity [stove construction] came when we had already started the project and the message had already been communicated that it [the project] is free, so we will have challenges if we start charging now, and it will be contrary to our project guidelines.* (BCCLW MZ2)

The general structure of coordination: In the citation above (#1757-1760), I traced the general structure of coordination. The script coordinating participants' actions was the project guidelines and the previous promotion messages. The participant did not question how the project guidelines were a contributing factor to slowing stove uptake.

Participant FC continued with committing 'not' to take actions by suggesting that the conflict of motives should be taken as a way forward for contradiction 1 (see Chapter 7, Table 7.6 and Section 7.3.3).

> **#1773 *Participant FC:*** *No madam that should come as a way forward for the problem with ndhulani.* (BCCLW MZ2)

The 'commitment 'not' to take actions' gained ***collective agency*** from another Field Facilitator:

#1777-1778 Participant AK: *For me I think we should not include that as a problem because as we have discussed here we have understood very well, but when the issue goes to the community people will just say, they have started charging.* (BCCLW MZ2)

In the excerpts above (#1757-1760; #1777-1778), the Field Facilitators were of the view that the community might misinterpret the message that the project had started charging for the stove and it might scare them away.

Second stimulus-second set: I introduced the triangular model as a second set of second stimuli, to help participants see the possibility of reorganising the activity in order to resolve the conflict of motives and address the fears they envisaged. I highlighted the tools of the implementer activity system and explained how they could utilise some of them to ensure that community members received proper communication about the envisaged change. Immediately after this, *Participant FC* emphasised that we should not endorse the conflict of motives as a problem but as a way forward. Then a stove constructor expressed envisioning as follows:

Envisioning:

#1819-1826 Participant MN: *My thinking is that the implementers should be involved in telling the people that those people who can afford a little money [but cannot afford to collect the materials] can do so. This is because many people need the stove but they are not CADECOM members … But if these people can … request us to build them a stove and give us a little money, it would work better. Now, as we have gathered here, I suggest that we together with the implementers sit together with the community members, and the implementers should help us explain properly in a way that people should understand clearly. I think in so doing things can progress.* (BCCLW MZ2)

Auxiliary Motive: In the expression of envisioning above (#1819-1826), the participant suggested a 'meeting' as an **external stimulus** to help in resolving the conflict of motives, *Phase 3 in Apparatus 1.* Employment of the second stimulus, as explained above, stimulated the participant to use the meeting as a tool to help in making a decision. However, before *participant MN* finished her turn, the Field Facilitator expressed 'resistance' and 'committing 'not' to take action' of endorsing the conflict of motives confronting the constructors as a problem as described earlier (#1757-1760; #1777-1778).

Resistance and committing 'not' to take concrete action:

#1827-1830 Participant FC: *That is a very good suggestion; it shows that we never thought about it. However, for it to proceed well without miscommunication, it should be on the way forward [for the contradiction 1]. But it is a good suggestion that if we can use it, it can help us a lot. Because when they [stove constructors] tell the non-CADECOM members that they cannot build them stoves, it is as if we are isolating them, yet we are together; those who attend CADECOM meetings, those who do not, we have to protect the forest …* (BCCLW MZ2)

Reflective talk: Ability to look into oneself, reflecting on and talking about the social world and a shift into the general structure of cooperation:

Despite 'resisting' and 'committing 'not' to take action', *Participant FC* (#1827-1830) reflected how they (implementers) had overlooked what *participant MN* (#1819-1826) described. He also indicated that he had learnt that protecting the environment was a joint activity and that isolating people based on their membership in the project may not facilitate achieving the object of protecting the environment through uptake and use of the ICS. He also indicated that what he had learnt could be used to change the practice. Further, the realisation that protecting the environment is a joint activity gained ***collective support:***

> **#1863-1865 *Participant RS:*** *… if someone approaches the group with little money requiring a stove, the group should be able to hold a meeting and organise themselves to construct her a stove so that she also should stop going to the forest frequently.* (BCCLW MZ2)

Further, I was able to trace the general structure of cooperation in *participant FC's* speech (#1827-1830) when he focused his attention on the shared object of protecting the forest as involving every community member. However, he stuck to the earlier decision to put it as a way forward. Then another Field Facilitator moved back to coordination:

The general structure of coordination:

> **#1831 *Participant AK:*** *Yes, isolation exists because they [non-CADECOM] members isolated themselves initially by not being in the project.* (BCCLW MZ2)

It is worth noting that *Participant MN's* transformative agency expression (#1819-1826) did not get collective support from implementers. However, a stove constructor and a potential user expressed 'envisioning' in *collective support* to *Participant MN.* The 'meeting', as an external stimulus to help participants make decisions, gained ***collective agency*** (#1863-1865; #1837-1835; #1867-1869) through 'envisioning'.

Envisioning:

> **#1837-1855 *Participant DC***: *… if we organise a meeting and discuss with others and they understand properly – because many people want the stove, but the problem is to collect the materials. …. However, if they would understand, we will benefit more in future. … because those of us who have stoves are few. So, if we take what we have discussed here, and when we go home, we should sit down and explain in ways that people can understand. When they endorse it, we will start using that procedure because this year many people from Tchesamo area have approached us to construct them stoves.* (BCCLW MZ2)

> **#1867-1869 *Participant FN***: *For us to progress, after the learning process we need to go home and teach others so that they understand, and we can build the stoves together.* (BCCLW MZ2)

Additionally, participants focused attention on the shared object – ***the general structure of cooperation*** (#1819-1826; #1827-1830; #1863-1865; #1837-1855). Participants tried to find mutually acceptable ways of resolving the conflict of motives. However, there was some division between the other activity systems and the implementer activity system. Other activity systems ***collectively supported*** the conflict of motives as a problem that needed to resolve:

> **Researcher:** *Now the point is should we endorse this as a problem like we have done with the others or not?*
>
> **#1872 Participants** *(except implementers): It's a problem!*
>
> **#1873-1876 Participant DM:** *Yes, I also think that it should be endorsed as a problem. When we discuss here it looks like it is not a problem, but it is indeed a problem, because the non-members are the ones who give us problems requesting for stoves, and we cannot construct them stoves free because they are the ones who also think that when we go for CADECOM sensitisation meetings we just waste our time …* (BCCLW MZ2)

While deliberating on this, another member expressed 'envisioning' echoing the idea of charging for the stove.

Envisioning:

> **#1908-1910 Participant MN:** *The problem is that most people especially those outside the project area do not know the stove construction group. If they knew, they could be consulting us without problems. Now how would they know? That is why I am requesting that the implementers should help us to spread the message to others.* (BCCLW MZ2)

In #1908-1910, *participant MN* made a preliminary suggestion on how they could proceed with the idea of charging for the stove by recognising the role and power the implementers have. Notice that she expressed this idea in #1819-1826, but there was no collective support.

After a long discussion, participants agreed to resolve the conflict of motives by including it as a way forward on scarcity of *ndhulani* (See Chapter 7, Section 7.3.3). However, the issue resurfaced on the last day during the follow-up closing session (see Appendix 15). One participant explicated new potential in the activity. She provided evidence of demand for stoves from an encounter she had during expansive learning processes. This echoed the past positive experiences that occurred in the activity (see *Participant DC,* Chapter 6, Section 6.4.4.3; and #1873-1876) that participants had not completely acknowledged during the questioning session as discussed above.

Explicating new potentials:

> **#22047-22054 Participant CB:** *I would like to add that the day before yesterday when the driver was picking us to the workshop, he asked me whether it is possible to construct the stove for people outside the project area if they need it. I told him, no problem. Then he asked whether we needed to collect the materials ourselves. I said we could negotiate … Then he said he needs the stove and asked that … we should construct him a stove.* (FUCS MZ)

The encounter with the truck driver could be looked at as a naturally occurring stimulus (second stimuli) that triggered volitional actions. The first was from *participant FC;* he made an 'implicit commitment' to formulate a rule concerning charging of stoves.

Implicit committing to concrete actions:

> **#22085-22086 *Participant FC*:** *Now that we are discussing about rules [consolidation of rules] we need to complete that issue – how are we going to do it [charge] when we construct outside the project area?* (FUCS MZ)

The participant continued with 'envisioning'. I have provided few citations below to illustrate this:

Envisioning:

> **#22093-22095 *Participant FC:*** *We should not charge a 500 Kwacha because someone is better off; we need to have one fixed price. Hence, we need to include that idea [in the new model].* (FUCS MZ)

> **#22100 *Participants FC:*** *It can be among the themes or a rule.* (FUCS MZ)

> **#22101 *Participant DC/CB:*** *It should be a rule.* (FUCS MZ)

> **#22103 *Participant FC*:** *For this to work efficiently it has to be a rule …* (FUCS MZ)

In the expression of envisioning, I was able to trace **collective agency**. Participants (including implementers) (see #22085-22086; #22103) expressed the need to formulate the rule to guide stove charging. This was a shift to the **general structure of reflexive communication** shifting from coordination (#1434-1437; #1441-1443) to cooperation (#1819-1826; #1827-1830*;* #1863-1865; #1837-1835). Participants reconceptualised the shared object – protection of environment is a joint activity that requires promotion of cookstoves to wider areas, the rules to operate outside the project area and to provide 'not all free' stoves in specific contexts, beyond stipulations in the project guidelines (see also # 22462-22473 below). The interaction between the actors was also reconceptualised. The mechanism for transition appears to be expansion, triggered by 'explicating' (#22047-22054).

> **#22462-22473 *Participant FC:*** *… When we go to construct stoves outside the project area we need to start sensitizing and teaching them first … We need to send the message not only to the potential owner of the stove, but to other women in the area so that you can teach many people. That means next time many people will be approaching you based on what they learnt about the stove, and you will be able to make more money.* (FUCS MZ)

'**Real' Conflict of stimuli and closure of conditioned connection:** Phase 4 occurred following the expressions of envisioning. Participants formulated a rule reflecting a comprehensive model for the future on how they would proceed with charging stove construction outside the project area. It also included how they would use the money. In this TAP, the 'rule' was a 'new' neutral stimulus, which took the form of a tool confronting stove constructors to guide them in the implementation of the decision. It was activated after completion of follow-up workshops when people outside the project area approached the stove constructors for the first time after the rule was formulated and they decided to construct the stove. It is worth noting that in Phase 3, the auxiliary motive was a 'meeting'. However, this did not progress to Phase 4.

Apparatus 2-Decision implementing: Stove constructors now construct stoves for people outside the project area guided by the rule and the plan developed (see Chapter 7, Box 7.2). This occurred after follow-up workshops and the information was obtained from a telephone interview (see Chapter 3, Section 3.7.7 and Appendix 10 and 25). The citation below illustrates this:

Taking consequential actions to change the activity:

> **Researcher:** *During the last meeting, we had agreed that when people go outside CADECOM project area to construct stoves, they could charge, but we did not conclude; what is the progress?*
>
> **Participant CB:** *… So far two members of the stove construction group went across the river; they constructed two stoves and charged MWK1500.* (FUD MZ)

8.2.2.3 Transformative Agency Pathway 3: Constructing stoves with pottery soil instead of ndhulani

The *general conflict of stimuli* is socio-economic demands *versus* environmental-health concerns (see Chapter 6, Section 6.4.1.3). The demands to provide low-cost technology to poor populations, which partly influenced implementers to adopt strength-based approaches (see Chapter 1, Section 1.7.2.3) to stove implementation to use locally available materials, were pulling in opposite directions with the demands to save firewood and prevent indoor air pollution. The conflict of stimuli activate *conflict of motives* in the TSF users: to walk long distances, spend time searching for *ndhulani* and save firewood on ICS *versus* to walk long distances, spend time collecting firewood and consume firewood on the TSF (see Chapter 6, Section 6.4.2.1).

The TAP started with presentation of *first stimulus* in session 1. It described the scarcity of *ndhulani* and the way it influenced potential user apathy in collecting construction materials, stove uptake, and how it is affecting stove construction (see Chapter 6, Sections 6.4.1.3 and 6.4.2.1). However, it did not yield any transformative agency expressions. In session 2, I introduced a *second stimulus-first set*, the triangular model to help participants locate the origins of the problem on the activity system triangle to stimulate their thinking on how to reorganise the activity. This yielded no expressions of agency. At the end of session 2, I gave participants a take-home assignment, as a *second stimulus-third set* to stimulate participants to help participants understand better the origins of the problems and stimulate their thinking towards modelling solutions. This triggered expressions of transformative agency. A participant expressed *envisioning,* reducing the amount of *ndhulani* to half (see Chapter 7, Table 7.7). I identified this as *phase 3*: a participant decides to resolve the conflict of motives by means of 'new ways of using' the old stove construction material. However, in session 5, another *external stimulus* was suggested: 'a new material', the pottery clay. Towards the end of session 4, I gave participants a take-home assignment to begin modelling solutions (see Appendix 14). This triggered *envisioning* in session 5, suggesting an experiment constructing a stove with pottery soil and seeing how it would perform. This gained *collective*

agency. Another *collective agency* was on reducing *ndhulani* with half (see above). At the end of session 6, I gave participants a take-home assignment (see Appendix 14) as *a second stimulus-fourth set.* This triggered *reflective talk on the practice* in session 7: a participant condemned the practice of leaving stove construction to women and looking at it as a woman's job and called for men to participate in the collection of pottery soil. It also triggered *commissive speech acts* when participants *collectively* committed to experiment with both solutions suggested. Participants *took actions* to change the activity by completing take-home assignments as described in between BCCLWs, including those described in Appendix 14 and Chapter 7, Section 7.3.6.1. I can infer the occurrence of *phase 4* after completion of BCCLW during experimentation. The *decision was implemented* through constructing stoves using pottery clay (see Chapter 7, Table 7.9).

8.2.2.4 Transformative Agency Pathway 4: Construction of standard kitchens

The general conflict of stimuli was socio-cultural demands *versus* environmental-health concerns, as well as top-down models and assumptions around socio-technical innovation implementation and adoption versus environmental-health concerns. The traditional practice around food sharing and marriage customs (see Chapter 6, section 6.4.1.1) pull in opposite directions with the demands to save firewood and prevent indoor air pollution. Similarly, the traditional practices pull in opposite directions with the tendency to provide stove designs mainly driven by external ideas (See Chapter 2, Section 2.11.1 and Chapter 6, Section 6.4.1.1) without providing communities with choices or considering their cultural practices. The conflict of stimuli activate *conflict of motives* in potential users: to construct a kitchen, save firewood and compromise food sharing and domestic chores *versus* consume firewood, share food and domestic chores. Another *conflict of motives* occur in the implementers: achieve environmental-health and sanitation agenda *versus* increase stove uptake and meet target numbers of ICS.

The TAP started in session 1 with the presentation of *first stimulus.* It described the need for a permanent kitchen to construct a stove due to the stove design that requires a permanent kitchen in line with the need to prevent indoor air pollution. It also described how absence of kitchens affected stove uptake (see Chapter 6, Sections 6.4.1.1; 6.4.1.2; 6.4.2.4). It triggered an *implicit commissive speech act* calling participants to work together with the men whose wives needed a stove to construct kitchens. It also triggered *reflective talk* on how stove implementation happened. The participant reckoned that the implementation plan should have and should encourage kitchen construction first. I also identified *resistance* towards the interventionist researcher. A Field Facilitator rejected the interventionist researcher's interpretation that the implementers overlooked kitchen construction as part of the implementation plan. The script, 'the need to achieve sanitation', *coordinated* the Field Facilitators in making decisions regarding understanding the stove design as the source of the problem.

The Field Facilitator employed a *second stimulus-first set,* the triangular model, to identify the roles of the people responsible for resolving the problem and used *envisioning,* suggesting who should lead in resolving the problem and who should assist in case of failure to resolve the problem. He then used an *implicit commissive speech act*, calling for the need for all actors including chiefs to collaborate in resolving the problem and calling for the volunteers (see Chapter 1, Section 1.7.2.3) to assist the vulnerable unable to construct kitchens. Another participant *explicated* how it was possible to build stoves without a chimney by relating to the stoves she constructed for teachers living in government houses where it was not permitted to drill a chimney. However, the participant's critical attention was on a *partial object*, saving firewood; she did not reconceptualise the script, the 'need to achieve sanitation' and 'address indoor air pollution'.

In session 2, I introduced a *second stimulus-second set*, the triangular model to help participants locate the origins of the problem in the activity system triangle to stimulate their thinking on how to reorganise the activity in order to resolve the conflict of motives. This yielded no expressions of agency. At the end of session 2, I gave participants a take-home assignment, as a *second stimulus-third set* to help participants understand better the origins of the problems and stimulate their thinking towards modelling solutions. This triggered transformative agency expressions in session 3. A participant expressed *envisioning,* suggesting that the Village Chiefs should take part in mobilising community members in constructing kitchens. This gained *collective agency*. Another expression of *envisioning* from another participant was that husbands and wives should collaborate in dividing roles in building kitchens. Towards the end of session 4, I gave participants a take-home assignment to begin modelling solutions. This triggered several *envisioning* expressions in session 5, suggesting that when people get married they should not stay in the parents' house, but on their own and build their own kitchen and stove; that chiefs should take part in sensitising and encouraging the community, especially new couples about the need of kitchens and stoves. Participants *collectively* modified this into a rule that chiefs should establish in the community. Another suggestion was that before a man married, he should construct all the health sanitation facilities, including a kitchen and a stove.

During solution examination, another expression of *envisioning* was to organise incentives in the form of competitions between villages to attract community members to construct many kitchens and stoves. Another participant expressed *implicit commissive speech act,* explaining how BCCLW participants should approach members of the community when sensitising them about the traditional practice of sharing kitchens with parents during experimentation stage (see Chapter 6, Section 6.4.1.1).

In this pathway, *phase 3* was accomplished by means of a series of rules; however, *collective agency* focused on the establishment of a code of practice (see Chapter 7, Table 7.8) and the need for collaboration between community members and all actors in resolving the problem. Participants *took actions* to change the activity by completing take-home assignments in between sessions as described earlier including those described in Appendix 14 and Chapter 7, Section 7.3.6.1. I can infer that phase 4 took place outside the BCCLWs (see Chapter 7, Section 7.3.6.1). The decision was implemented through constructing a kitchen (see Chapter 7, Photo 7.11 and Box 7.2).

8.2.2.5 Transformative Agency Pathway 5: Constructing stoves with goats dung instead of cow dung
The *general conflict of stimuli* are socio-cultural demands *versus* environmental-health concerns, as well as top-down models and assumptions around socio-technical innovation implementation and adoption *versus* environmental-health concerns and socio-economic demands versus environmental-health concerns (see Chapter 6, Sections 6.4.1.3 and 6.4.2.3). There were pulling forces between the need for cow dung to construct an ICS *versus* being charged; the need for low-cost technology *versus* the need for money in exchange of cow dung for stove construction and the tendency to provide stove designs mainly driven by external ideas *versus* saving firewood and prevention of indoor air pollution. The conflict of stimuli activate *conflict of motives* in the potential users: to walk long distances, spend time searching for cow dung and save firewood on ICS *versus* to walk long distances, spend time collecting firewood and consume firewood on the TSF (see Chapter 6, Section 6.4.2.3).

The TAP started in Session 1, with the presentation of *first stimulus* describing the shortage of cow dung in the study area, problems potential users experience when they go to search for cow dung, such as being asked to pay money and covering long distances, and how this affects stove uptake (see Chapter 6, Section 6.4.2.3). The first expression of agency was *envisioning* suggesting experimenting with goat dung. This was an auxiliary motive phase; a participant turned to a new construction material to resolve the conflict of motives. This suggestion gained *collective agency*. Another user expressed an *implicit commissive speech act* calling for the participants to find a new solution to the problem. In session 2, I introduced a *second stimulus-first set*, the triangular model to help participants locate the origins of the problem in the activity system triangle to stimulate their thinking on how to reorganise the activity. This yielded no expressions of agency. At the end of session 2, I gave participants a take-home assignment, as a *second stimulus-second set* to stimulate participants to help participants understand better the origins of the problems and stimulate their thinking towards modelling solutions. This triggered expressions of agency in session 3. One participant expressed *envisioning* reducing the amount of cow dung to half, or experimenting with replacing cow dung with goat dung (see Chapter 7, Section 7.3.3 and

Table 7.7). The latter gained *collective agency* from session 1 (see above). Towards the end of session 4, I gave participants a take-home assignment to begin modelling solutions (see Appendix 14). This triggered *envisioning* expressions in session 5, suggesting experimenting with constructing a stove with goat dung in place of cow dung. The idea gained *collective agency* from session 1 as discussed above. Other *envisioning* expressions were to combine 10 litres of cow dung and 10 litres of goat dung and experiment with one stove; to increase the amount of sand and to follow prescribed measurements of construction materials. During examining solutions in session 5, a participant used an *implicit commissive speech act* by laying down the order of experimentation process, and called for participants to follow the order during the experimentation stage. Participants *took actions* to change the activity by completing take-home assignments as described in between BCCLWs, including those described in Appendix 14 and Chapter 7, Section 7.3.6.1. I can infer that phase 4 took place outside the BCCLWs when participants decided to replace cow dung with goat dung. The decision was implemented through constructing stoves using goat dung (see Chapter 7, Table 7.9).

8.3 Conclusion

This chapter has discussed the emergence of will and volitional actions from participants. It has shown how expansive learning supported with BCCLW and double stimulation tools triggered transformative agency and reflexivity in participants, mobilised and supported their agency to transform their activities. Using participants' expressions of agency and actions, the chapter has shown that actors working in the ICS, especially end-users who are put on the periphery in socio-technical transitions, and the women producers whose voices are not usually heard, can change their own lives if they are put in the **centre** of the development, diffusion and adoption processes. The chapter has discussed how participants collaborated in their work towards transformation of their activities using coordination, cooperation and reflexive communication. The discussion shows that other TAPs were concluded while others were opened as mapped out in detail in Chapter 9, Figure 9.1. This indicates the difficulties in mobilising agency at different levels of the socio-technical innovation system-involving multi-stakeholder in cross-boundary work (see Chapter 9). There were a few theoretical insights derived from the employment of the integrated analysis using Sannino's Vygotskian double stimulation model. I discuss these in Chapter 9.

CHAPTER 9: TAKING END-USERS OF IMPROVED COOK STOVE SOCIO-TECHNICAL INNOVATION FROM PERIPHERY TO THE CENTRE

9.1 Introduction

This chapter provides an overview of the work accomplished in the study. The chapter starts with an overview of the thesis. It highlights the problems identified in literature in the implementation of Improved Cook Stove (ICS) socio-technical innovation and within the case studies under investigation, because they provided the foundation and impetus for carrying out a change-oriented-learning study in order to transform the ICS practice. The chapter provides a brief review of the theories and methodologies used to accomplish the transformative and emancipatory agenda of the study. It provides the key findings, contributions to new knowledge and recommendations.

9.2 Overview of the study: A short description of the ICS activity transformation process

In the first phase of the thesis, it seemed that the path through to transformation of the ICS practice might be impossible. Chapter 1 highlighted environmental, health and social problems facing people using biomass on open fires globally and in Malawi (see Section 1.1) and the problems facing the ICS practice in Malawi (see Section 1.5). Chapter 2 highlighted the top-down dissemination approaches inherent in the ICS innovation transitions emanating from foundational assumptions and power dynamics in socio-technical transitions, that put the end-user on the periphery of development and diffusion processes, which affect uptake and sustained utilisation of the ICS. It revealed gaps in change-oriented-learning within the interventionist approaches used in ICS diffusion. Chapter 3 discussed change-oriented-learning theories and methodologies that attempted to bridge the gaps identified in the literature on ICS development and dissemination approaches as reviewed in Section 9.2.1 below. Chapter 4 highlighted factors hindering uptake and sustained utilisation of ICSs. Chapter 5 highlighted the unidirectional learning interactions (see Figures 5.19; 5.20 and 5.21 and Section 5.6) and tenuous interactions among key actors (see Section 5.5). The chapter revealed that most of the learning taking place in the ICS practice was informative but inadequate (see Section 5.6). Chapter 6 discussed contradictions constraining learning, uptake and sustained use of the ICS innovation within the three case studies.

In the second phase of the thesis (Chapters 7 and 8), findings of the study showed that transformation of the ICS practice was possible through bridging theory and practice in the ICS practice by enhancing reflexivity and learning interactions among actors, and evoking and supporting individual, relational and collective transformative agency in and among actors. In addition and most importantly, this can happen by practically *putting end-users and producers in the centre from periphery in socio-technical transitions*

using the expansive learning processes. The expansive learning processes were activated and supported using the change-oriented-learning theories and methodologies as discussed in Section 9.2.1 below.

9.2.1 Overview of theories and methodologies

The study intervened and analysed ICS practice via Critical Realism (CR) and Cultural Historical Activity Theory (CHAT) as outlined in Chapter 3. Using Formative Intervention research (see Section 3.5.1), I supported actors working in ICS activity and communities trying to adopt the ICS technology to cope with the challenges in their activities and resolve contradictions constraining the learning, uptake and sustained utilisation of the technology. Using this approach, the study focused and built its thrust on contradictions, in the interacting ICS activity systems investigated to bring change and development (see Section 3.4.3). Further, in order to support and develop learning in the ICS activity, the study employed Developmental Work Research (DWR) and/ Expansive Learning (see Section 3.5.2) in line with the change-oriented-learning approach. The approach was based on the seminal findings of Vygotsky's work and idea that 'learning leads development' (Vygotsky, 1978, p. 90) and that learning can lead to evolution of new human activity in open systems (Engeström, 2001). The findings of this study echo this (see Chapters 7 and 8).

CHAT enabled me to co-develop with participants, a deeper understanding of the ICS socio-technical system (in the three case studies in particular) in Malawi and globally with its emphasis on the role of socio-cultural historical factors in shaping human activity, as thoroughly discussed in Chapters 1, 2, 4, 5 and 6. These chapters were foundational and provided essential preparation for the expansive learning processes reported in Chapters 7 and 8. Using Boundary Crossing Change Laboratory Workshops (BCCLWs), I brought key actors in the ICS practice together in a learning space; they deliberated on the limitations, tensions and problems facing the ICS practice and found workable solutions (see Chapters 7 and 8), supported by a series of tasks which they undertook in between the BCCLWs. This process bridged the rather fragmented interplay between technical and process elements in the analysis of ICS socio-technical innovation uptake and utilisation, and this enhanced learning interactions among key actors in the Chapita and Waziloya Makwakwa case studies (see Chapters 7 and 8).

The study used CR as philosophical underlabourer of CHAT because of its commitment to changing unsatisfactory or oppressive realities through stimulating agency and reflexivity in communities to solve problems facing their lives in reflexive relation to structural constraints (Sayer, 2000; Benton & Craib, 2001; Daniels, 2008) (see Section 3.2.2). In this study, the identification of contradictions drawing on CHAT's dialectic and critical realist causal mechanisms and focusing on transformation of ICS practice through resolving contradictions, provided a different and robust scientific enquiry. The enquiry and approach foregrounded the emergence of learning out of the need to absent something that had been left out (Nunez, 2014) in the ICS activity. This provided a different way of approaching dissemination of socio-technical innovations, which have suffered top-down approaches and evaluative studies that

seemingly dwell on surfacing barriers (see Chapter 2) without engaging more deeply with issues of structure from a critical realist stance, and evoking actors' cultural historical experience and agency to transform the practice. CR enabled me to understand more deeply how structural factors shape transformative agency and potentials of various actors working with ICS (see Chapter 5, Section 5.6 and Chapter 6, Section 6.7). This enabled the development of a better explanation of why the ICS technology was the way it was as described in Chapters 1, 2, 4, 5 and 6 and finding workable solutions with research participants as discussed in Chapters 7 and 8.

Drawing on CHAT, the study employed a two-phased formative interventionist research design (see Section 3.6.2). The exploratory phase helped in gaining an in-depth understanding of the ICS innovation practice. This phase involved understanding the profile of uptake and utilisation of the ICS; factors that promote and hinder uptake and utilisation of ICS technology and it helped me to answer *question 1* (see Chapter 4). It involved identifying key actors in each case study, the way they interact and understanding what they learn and most importantly, how they learn the ICS innovation during interactions and it helped me to answer *question 2* (see Chapter 5). Further, it helped in understanding the problems, limitations, and tensions existing in the learning, uptake, and utilisations of ICS technology, and helped me to answer *question 3* (see Chapter 6). In the expansive phase of the study, I worked with research participants from the Chapita and Waziloya Makwakwa case studies to identify and analyse contradictions derived from the exploratory phase, and modelled and implemented solutions to some of the contradictions. This helped me to answer *question 4* (see Chapters 7 and 8). The analysis from preceding chapters helped me to develop an Innovative Extension and Communicative methodology (see Figure 9.3 and Table 9.2), which foregrounds interaction and expansive learning in ICS implementation and diffusion, and helped me to answer *question 5.*

Using the theories, approaches and methodologies, the study has attempted to bridge the theory-practice gap through change-oriented-learning processes that emphasised horizontal learning among actors in ICS practice. The study has addressed some of the challenges in ICS practice systemically and relationally by focusing on the interplay between elements of each activity system involved in ICS technology and between the activity systems, and the interplay between structural and process elements regarding ICS technology development, diffusion, uptake and utilisation. The study emphasised supporting communities adopting ICSs to find locally acceptable solutions consonant with Education for Sustainable Development (ESD) and Education for Sustainable Consumption (ESC). It is the aim of ESD to provide knowledge, values, and skills to enable individuals and social groups to become actors of change towards more sustainable consumption behaviours (UNEP, 2014). ESC, as an aspect of ESD, advocates providing citizens with the appropriate information and knowledge on the environmental and social impacts of their daily choices, as well as workable solutions and alternatives (ibid.).

The study built on previous ICS interventions in the country and has offered an approach that potentially informs future interventions in ICS practice, which is a different approach from approaches used globally as discussed in Chapter 2. In this way, the study contributes to diffusion of socio-technical innovations, in general and specifically to processes in the development, diffusion and utilisation of ICS technology. It also contributes to technological innovation studies with a shift in approach that aims at addressing learning-knowledge-sharing gaps among actors involved in ICS innovation practice. The shift is inherent in its focus on learning as emancipatory process achieved through transformation of human practice – the ICS practice, which I facilitated through evoking transformative agency and enhancing reflexivity among actors that participated in the study. Evoking transformative agency in research participants empowered research participants to deal with challenges facing their lives.

The methodology of expansive learning that the study employed helped me to put the primacy on communities as leaners. With transformative agency and reflexivity developed, interaction enhanced, communities took charge of the learning processes (see Chapters 7 and 8). The study shows that expansive learning brought about change and development in the ICS practice by moving away from the language of "barriers" to "contradictions" in the diffusion of ICS innovation, which are a source of learning and development. The study not only identified contradictions, but equipped communities with the knowledge and learning skills to trace the origins of the contradictions. This helped communities to find locally acceptable solutions to their problems through experimentation with both the problematic situation and the solution – a source of learning, empowerment and emancipation.

The study therefore contributes to various environmental education processes that are trying to address absences or ills in society. The study has potentially addressed some of the constraints on the well-being of children (accompanying their mothers) and women in the cooking activity by finding solutions to some problems faced in the uptake and utilisation of the ICS technology (see Chapters 7 and 8) (see also Figure 9.1). Hence, the study contributes to both local and global efforts in climate change mitigation and adaptation through protection of the remaining forests and reduction of environmental health risks associated with the burning of biomass in inefficient cookstoves.

By focusing on object-oriented activity (see Chapter 3), the study engaged with the main goals and objectives for ICS intervention in Malawi. This, as indicated earlier, evoked reflexivity in practitioners leading them to question whether they achieve the objects of their various activity systems. The process created *cracks at the knowledge level* in different activity systems, which are germ cells for change in the ICS activity. I highlight one example from the policy activity system (Deputy Director) and two from implementer activity systems (Field Facilitator and Project Officer) (see citations below). Yet, in some cases the object was re-conceptualised with varying degrees (see Chapter 8 and Figure 9.2A).

> **Deputy Director DoEA:** *Dear Experencia, thanks for the report. It is very interesting. It is an eye opener to some of us. We have always claimed that we have to date (from 2012) disseminated*

about 400 000 improved stoves across the country but we will be surprised to learn that very few are in use due to some of the reasons you have mentioned in the report. (email, 19 July 2016) (Chisoni, 2016b).

7229 Field Facilitator LM: This research will help us examine some of the project activities that we have been engaged in. (BM BK1)

7270 Field Facilitator LM: You have opened my eyes. This research has opened my eyes. (BM BK1)

Project Officer: As we were talking, I have picked some points that will help me in the project. (Interview # MZ8)

9.3 Key findings, contributions to new knowledge and recommendations

In this section, I provide analytical statements that identify the key findings of the study, contributions to new knowledge and recommendations emanating from them.

9.3.1 Contribution to new knowledge in socio-technical transitions, climate change mitigation, and adaptation

As discussed in the study, the woman, the end-user of the ICS, has been left on the periphery in the socio-technical transitions because of the current power dynamics manifesting through top-down models in socio-technical transitions (see Chapter 2 and Chapter 6, Sections 6.3.3.1 and 6.5.2.6). The cooking culture of the woman (see Chapter 6, Sections 6.3.1, 6.4.3 and 6.5.1) and their learning potential (see Chapter 6, Sections 6.3.3.1 and 6.3.4.1) have been neglected due to the foundational assumptions in socio-technical transitions that neglect cultures of practice, which tend to put people who use the technologies last instead of putting them first (see Chapter 2 and Chapter 6, Sections 6.3.3.1, 6.3.4.1, and 6.5.2.6).

This study has challenged these assumptions and shifted the current power dynamics through spending more energy, effort and time and respect on the cultures of the woman who use the innovation. *The study has shown that it is possible to put the agency of end-users in the centre of the ICS socio-technical innovation to transform the activity, in the mitigation and adaptation of climate change utilising socio-technical innovation solutions* (see Chapters 7 and 8). The study has brought the periphery to the centre by looking at end-users' agency and mobilising transformative agency, relational agency, reflexivity, collaboration and expanding their learning (see Chapters 7 and 8). These processes were needed to further support their agency. The study has accomplished this by foregrounding the actual process of agency development (see Chapters 7 and 8) in ICS implementation in ways that has taken account of the marginalised people normally seen at the bottom end, including their views, voices, thoughts and actions (see Chapters 6, 7 and 8).

Therefore, I *recommend* a paradigm shift in the power dynamics in socio-technical transitions among donors, policy makers, implementers and ICS designers, and producers to put the end-user in the centre in the promotion and implementation of socio-technical innovations in climate change mitigation and adaption processes in order to make tangible progress. This means putting their views, voices, thoughts, and actions, in the centre of design and implementation of socio-technical innovations and their learning. In addition, stove designers should respect the cooking culture of women by promoting ICS designs that are convenient from the end-user's perspective and not from the implementers' and designers' perspectives as has been the case to date (see Chapter 1, Section 1.7.4, and Chapter 2, Section 2.6). This is because the study has shown that convenience in terms of saving cooking time promotes sustained utilisation of the ICS (see Chapter 4, Section 4.3.4).

9.3.2 Contribution to new knowledge in community education

As discussed in the study, there is no framework for engaging multi-stakeholders in the diffusion and implementation of socio-technical transitions that foregrounds the actual processes of agency development and reflexivity (see Chapter 2). Yet, interaction between structural elements in the ICS innovation system is tenuous (see Chapter 1, Section 1.5, Chapter 5, Section 5.5 and Chapter 6). Most process elements are under-developed (see Chapter 1, Section 1.5 and Chapter 6, Section 6.7) and the level of participation of grassroots actors is superficial (see Chapter 2, Section 2.6 and Chapter 6, Sections 6.3.3.1 and 6.3.4.1).

This study has shown that *third generation Cultural Historical Activity Theory-boundary crossing provides rigorous mediated processes of participation, which allows multi-voicedness as a framework to engage with multi-stakeholders in the implementation of socio-technical innovations.* The study, therefore, contributes to *a "transversal transition-driven" approach to community education in the implementation of Education for Sustainable Development, which is neither top-down, nor naively bottom-up in orientation* Wals, Mochizuki & Leicht, 2017 p.789). Wals et al., commenting on other southern African CHAT research studies (Lotz-Sisitka et al., 2017) that showed similar agency-oriented findings based on Expansive Learning and BCCLWs, noted that this offers a potentially new and interesting orientation to community-based approaches to Education for Sustainable Development. Thus also positioning this study in this emerging body of community-based Education for Sustainable Development research and praxis. The third generation CHAT boundary-crossing framework supports mobilisation of transformative agency, which is vital for the restructuring of the foundational assumptions of ICS implementation and the transformation of power relations in the cook stove system of activity. It allows collaboration among actors in the ICS activity and puts the end-user in the centre (see Chapters 7 and 8), builds a sense of ownership in end-users (see Chapters 6, Sections 6.5.2.6 and 6.7), which is crucial for the uptake and potentially sustained use of the ICS (see Chapters 7 and 8).

Therefore, I *recommend* that researchers and practitioners working with ICS socio-technical innovation engage in boundary-crossing work and change-oriented expansive learning approaches in the dissemination and implementation of ICS innovation. Further, donors should allow reasonable periods for funded projects because boundary-crossing work requires longer time-periods and intensive engagements and effort. Most participatory approaches suffer time pressures and financial commitments from donors (see Chapter 2, Section 2.6.2, and Chapter 6, Sections 6.3.4.1 and 6.7).

9.3.3 Contribution to new knowledge in theories and methodologies

Multi-level scaling and boundary crossing: The study shows how CHAT coupled with formative intervention approach mobilises Transformative Agency Pathways (TAPs) (see Chapter 8). The study shows that when agency is mobilised, it spans in spatial, temporal, and social dimensions (see Chapter 7, Box 7.1, 7.2, and Chapter 8), and via this, generatively scales and expands women's empowerment. However, the study shows that while many TAPs were opened (see Chapter 8), some were concluded as 'intended', but some were not (see Figure 9.1). In the Chapita case study, the TAPs concluded were cooking *nsima* on ICS with support (Section 8.2.1.1 and TAP 1B in Figure 9.1), scarcity of stoves and low stove price (Section 8.2.1.2 and TAP 2A, 2C in Figure 9.1) and putting the end-user in the centre from periphery by acknowledging their learning potential (at the grassroots level) (Section 8.2.15 and TAP 5A in Figure 9.1). In the Waziloya Makwakwa case study the TAPs included heat regulation for convenient cooking (Section 8.2.2.1); stove construction as source of livelihood and managing group activity (Section 8.2.2.2); constructing stoves with pottery soil instead of *ndhulani* (Section 8.2.2.3); construction of standard kitchens (Section 8.2.2.4) and construction of stoves with goat dung instead of cow dung (Section 8.2.2.5) (see Figure 9.1). The TAPs that were not concluded were cumbersome production processes due to complicated production tools (sub-pathway) (Section 8.2.1.2, and Figure 9.1 TAP 2B); addressing delayed cooking on ICS (Sections 8.2.1.3, and Figure 9.1, TAP 3) and preserving the stove from cracking on the upper door (Section 8.2.1.4) (see Figure 9. 1, TAP 4).

This study has shown that *in working with third generation CHAT boundary-crossing, mobilisation of agency and scaling is easier at the grassroots level where less boundary-crossing is needed but more difficult at other levels of the system that require more boundary-crossing in multi-stakeholder multi-level ICS Social Technical System expansive learning engagements.* As indicated above, the TAPs that were not concluded, required national and international multi-stakeholder involvement in the design of tools and the stove,[40] that needed more time and work (see also Chapter 7, Section 7.2.6.1) which was outside the scope of this study. This finding shows *the extent to which an interventionist researcher can go with*

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[40] Chitetezo Mbaula is a stove promoted nationally by Government of Malawi and NGOs (see Chapter 1, Section 1.4.4.2) and it is designed with the help of international experts.

mobilisation of agency in multi-level systems. Yet for the Waziloya Makwakwa case study, the tools and stove design were under the mandate of the local implementers (see Chapter 1, Section 1.7.2).

Therefore, I *recommend further research* for different kind of boundary-crossing engagement in multi-level systems with many system boundaries. Further research is also needed to expand the TAPs that were not concluded (see Figure 9.1).

Figure 9.1: Transformative Agency Pathways (TAPs)

Source: Jalasi, 2018

KEY FOR TRANSFORMATIVE AGENCY PATHWAYS (TAPs):

GREEN: TAPs concluded
YELLOW: TAPs opened and <u>not</u> concluded
BLUE: Unique case TAP
TAP numbers correspond to TAP numbering in Chapter 8
TAP letters correspond to TAP sub-pathways
The outer circle shows the system level responsible for decision implementation **for each** TAP

KEY FOR SYSTEM LEVELS:

PINK: Local level
PURPLE: Local-National level
ORANGE: National-International level

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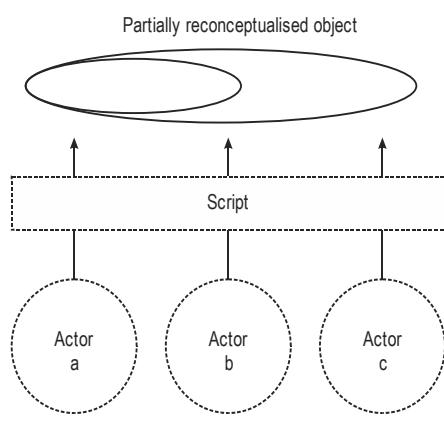
Figure 9.1 shows TAPs that were concluded (green) and opened but not concluded (yellow) in both case studies (see also Chapter 8). The figure shows that some *sub-pathways* in some TAPs were concluded while others were opened but were not concluded. The TAPs in the Waziloya Makwakwa case study were all concluded despite involving changes in stove and tools design, yet in the Chapita case study, all TAPs and sub-pathways that concerned changes in stove and tools design were not concluded. This is because the decision to change stove design and tools in Waziloya Makwakwa did not involve national and international multi-stakeholders. In Chapita, the TAPs that were not concluded required the mobilisation of agency at the national-international levels of the system, which makes the point that mobilisation of agency is easier at the local level of the system (the green TAPs) with less system boundaries than at the national-international levels (the yellow TAPs) with many system boundaries as indicated above. Similarly, the sub-pathway in blue is unique in that the decision formed for resolving the conflict of motives was to put the end-user in the centre, derived from the analysis. Its resolution was dependent on respecting the cooking culture of women through changing stove design; that is if TAPs 1 and 3 were concluded.

Sannino's (2015a) Vygotskian double stimulation model: The study shows how change emerges from expansive learning processes (see Chapters 7 and 8) through the development of transformative agency, reflexivity, and interaction among actors (Chapter 8). It shows a relationship between modes of interaction, reflexivity, and transformative agency expressions in the development of will and volitional actions. This study has shown that the three theoretical underpinnings are intertwined to some extent and all play a role in the emergence of will and volitional actions and the emergence of collective agency from individual actions with the aid of double stimulation tools. In addition to transformative agency expressions, *this study has shown that **reflexivity** and **modes of interaction** may play a role in the emergence of will and volitional actions in the processes of decision formation and implementation with the aid of double stimulation tools.* The integrated analysis using Sannino's (2015a) Vygotskian Double Stimulation model reveals the following theoretical insights with detailed evidence from TAPs in Chapter 8:
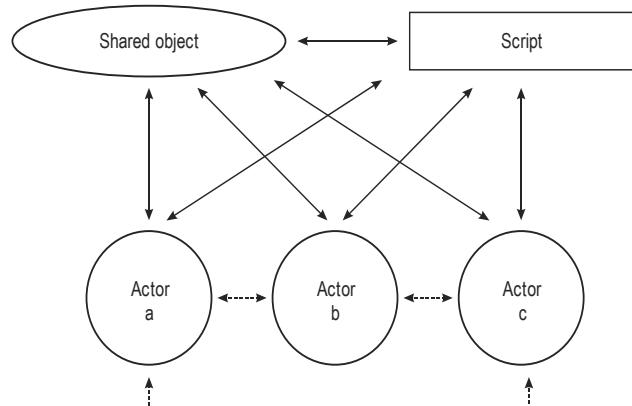
Modes of interaction: The analysis has shown that the general structure of coordination (Chapita TAP 2, #7703-7704) may trigger conflict of motives (#11301-11302, #11312). Yet, conflict of motives in some cases appeared to be mechanisms for transitions between modes of interaction. For example, the transition to cooperation (Chapita TAP 2, #2722-2728) was triggered by conflict of motives captured in (#2681, #2692-2696). Similarly, coordination (#8767-8768; #8780-8782) appeared to trigger reflexivity (# 8805-8815). In addition, coordination (#4983-4984) appeared to trigger reflexivity (#4987-4991). In some cases, when I characterised an expression as coordination, it also indicated transformative expression of the type commitment 'not' to take action (Chapita TAP 2, #4963-4965, #4983-4984, #4987-4991, #4993, #4994). Further, coordination appeared to trigger expressions of transformative agency in between use

of double stimulation tools. For example, in Chapita TAP 2, coordination (#7703-7704) to committing to take actions (#11419-11424, #1505-11514, #11600-11603, #11896-11903) and in Waziloya TAP 2, coordination (#1434-1437, #1441-1443) to envisioning (#1446-1456).

This study has shown that *other modes of interaction are identified other than the three modes* of coordination, cooperation and reflexive communication (see Chapter 3, Section 3.8.3.1). First, there was an attempt shift from coordination to cooperation in two scenarios in Chapita TAP 2, (#8389-8391) from *participant SB* and (#22705-22707) from *Field Facilitator AC*. In both scenarios, participants' critical attention was on a partial object. They reconceptualised the object partially. Figure 9.2A illustrates the mode of interaction. Second, it was an attempt at reflexive communication from cooperation, which results in a different mode of interaction. In Waziloya TAP 2 *participant DC* expression (Chapter 6, Section 6.4.4.3) and *Participant MN* (#1634-1639, #1641-1645), the shared object and the script was reconceptualised, but the interaction between the actors was not reconceptualised. This was traced in the implementer's resistance (#1677-1680, #1685, #1757-1760, #1773, #1777-1778). Figure 9.2B illustrates the mode of interaction.

Figure 9.2A   **Figure 9.2B**

Figure 9.2: Identified modes of interaction
Source: Adapted from Engeström, 2008, pp. 50-51

In Figure 9.2A, the oval inside the shared object denotes a partially reconceptualised object. In Figure 9.2B, the dotted lines between the actors indicate that the actors' collaboration in the work was weak i.e. not completely reconceptualised. Hence, the need to continue the expansive learning process with actors. This entails that Figure 9.2A is between the general structure of coordination and cooperation, while Figure 9.2B is between the general structure of cooperation and reflexive cooperation (see Chapter 3, Figure 3.6).

Transformative agency and collective agency: First, the analysis has shown that the most frequently occurring form of transformative agency expression is envisioning. This may be because participants had experienced the conflict of motives long before I interacted with them in the first phase and had started looking for ways to resolve the problems (see for example, Chapter 6, Sections 6.3.1.4 and 6.3.2.1, and Chisoni, 2015; Chisoni, 2014). Second, the study *identified additional expressions of transformative agency, which are 'offsprings' of the type commitment to take concrete actions:* **commitment 'not' to take actions** and **implicit commitment to take actions**. Commitment 'not' to take actions is important, as it seems to relate to the general structure of coordination as discussed above. Third, commitment to taking actions and taking consequential actions to change activity are sometimes expressed through actions, rather than verbal accounts. In all the TAPS, participants committed to taking actions and implemented the actions through completing tasks in between and after BCCLWs. Hence, the emergence of transformative agency also included participants' actions, to which researchers need to pay particular attention. However, the actions could differ from the actions identified in this study, given the fact that these actions were also supported and triggered by community engagement via the tasks prior to the agency expressions i.e. there is a form of consolidation of knowledge and solidarity building occurring via these community engaged interactions that occur between the BCCLWs that appears to be significant for supporting commitments to action amongst certain agents. Fourth, the study has shown that *for individual agency to unfold to collective agency, it may require determined and focused individuals.* The determination of *participant KG* in Chapita TAP 1 (#9708-9710, #9965-9966, #9968-9969) largely influenced the implementation of the tree fork decision. The determination of Field Facilitators in Waziloya TAP 2 (#1397-1405, #1434-1437, #1458-1460, #1677-1680, #1685, #1757-1760, #1773, #1777-1778) largely influenced the progression of the TAP, which without *participant CB's* encounter with the truck driver (see #22047-22054) would have not progressed to apparatus 2. This however, reflects the power relations and the top-down models inherent in socio-technical innovation transitions, as discussed in Chapter 2.

Reflexivity: In some cases, reflective talk (Lines 8805-8815) triggers expressions of agency (#8831-8833).

Double stimulation model phases: The analysis has shown that in real-life situations, the phases in Apparatus 1 may be difficult to capture because the researcher may not be available during the occurrence. For example, phase 4a and 4b. Similarly, the phases do not occur immediately and in succession. For example, in TAP 1 in the Chapita case study, the auxiliary motive phase occurred during BCCLW session 2. However, phase 4 and implementation took place after the experimentation stage during the time I conducted follow-up workshops since most participants did not favour this solution initially (see Chapita case study TAP 1). The report from Cleaner Cooking Camp (see Chapter 7, Section 7.2.6.1) played a greater role in turning the participants' agency to implement the solution. This also

resonates with the fact that the expansive learning cycle is iterative in nature. Similarly, all the TAPS phase 4 may have occurred outside the BCCLWs. It is also important to note that the occurrence of the phases may take a long time and therefore one can only trace them with constant follow-ups for a longer period. In some cases, it may be difficult to relate the occurrence of the phases, such as decision implementation to the transformative agency mobilised through expansive learning processes due to the temporal and spatial factors, for example, the price adjustment (Chapita TAP 2).

The theoretical insights are not conclusive since in some cases there were few occurrences. Therefore, I *recommend further research* into these theoretical insights to provide further evidence from future analyses of expansive learning processes using different data sets.

Critical Realist generative mechanisms: The study shows that identification of generative mechanisms influencing contradictions via a Critical Realist stance provided a deeper understanding and explanation of the ICS socio-technical innovation (see Chapter 4, Section 4.5; Chapter 5, Section 5.6 and Chapter 6, Section 6.7). The study has shown that *understanding of structural factors such as poverty and power relations (Chapter 6, Section 6.7) shape transformative agency and potentials of actors in decision formation and decision implementation during expansive learning processes* (see Chapter 8, Section 8.2.1.1, 8.2.1.2, 8.2.2.2 specifically, and other TAPs). *It informs how to mobilise transformative agency at different levels of the ICS Social Technical System necessary for the progression needed in ICS socio-technical transitions* (see Figure 9.1).

I therefore *recommend that scholars* trying to understand complexities of adoption of ICS socio-technical innovations should approach the topic via identification of contradictions and generative mechanisms influencing them, giving attention to the understandings of generative mechanisms provided by Bhaskar's Basic Critical Realism. This is because it helps to probe for ontological depth as a potential analytical and theoretical framework to describe transitions from traditional cooking technologies to ICS technologies as the study has identified this as a gap in the literature on ICS adoption (see Chapter 2).

9.4 Case-based recommendations

Table 9.1 provides recommendations for various activity systems for each case study. Recommendations for policy activity systems cut across all case studies and for ICS technology implementation in the country. Similarly, some recommendations for implementers for Chapita case study apply to Chilije case study because the same institution implemented the projects (see Chapter 1, Section 1.7), while some apply to all implementers in the three case studies.

Table 9.1: Case-based recommendations

Case Study	Recommendations
Chapita Village case study	**Recommendations for the policy activity system** ● The National Cook Stove Steering Committee (NCSSC) should strengthen collaboration and interaction among all actors (see Chapter 1, Table 1.2) to create spaces for learning, knowledge, insights, and experiences sharing related to the ICS technology at the local, national, and international levels of the ICS Social Technical System. This is because the study has shown tenuous interaction among actors (see Chapter 5, Section 5.5), which affects both uptake and utilisation of the technology. However, the study has revealed that no interaction model exists to facilitate the interaction and processes to guide project implementation. Therefore, *I propose an Innovative Extension Communicative Methodology that foregrounds interaction and expansive learning* to enhance future interactions among actors and guide diffusion processes (see Figure 9.3). ● The Department of Energy Affairs (DoEA) through the Ministry of Natural Resources Energy and Environment should introduce *Energy Extension Officers* in the districts as government permanent structures to facilitate energy related projects including the promotion of ICS. This is because the study has shown a gap in this area. This gap affects ICS uptake and utilisation because NGOs' projects phase out before achieving tangible results on the ground (see Chapter, Section 1.2.1, and Chapter 6, section 6.3.4) and there are no existing structures to take over the role of the NGOs. ● NCSSC should develop and oversee the effective use of policies that NGOs should follow in the implementation of stoves that target the end-user and utilisation of the ICS. This is because the study has shown that the project implementation tends to target production and put end-users on the periphery (Chapter 1, Section 1.5, and Chapter 6, Sections 6.3.3.1, 6.3.4.1 and 6.5.2.6). ● The NCSSC should include representatives of end-users and village production groups in the committee, as the study has shown a gap in this (see Chapter 5, Figure 5.23). Yet there is information gap at the NCSSC of the realities in terms of ICS utilisation (see Chapter 6, Section 6.3.4 and Section 9.2.1 above). This will help provide the necessary feedback from what is happening at the grassroots level, which can inform decision formation and implementation processes. ● The DoEA and NCSSC should develop structural and process elements, strengthen them and translate them into practice, since the study has shown that they are either absent, weak or ineffective (see Chapter 1, Section 1.5; Chapters 5 and 6). **Recommendations for the implementer activity system** ● Implementers should work with end-users in the design of a culturally acceptable ICS as the study has shown that design issues affect utilisation (see Chapter 6, Section 6.3.1.1 and 6.3.1.4) yet the end-users have no choice for the type of stove to be disseminated (Chisoni, 2014). ● There is need for research to establish the cause of the crack on the upper door of the Chitetezo Mbaula stove since the study has shown that there is knowledge gap in this issue (Chapter 6, Section 6.3.2.1). ● Implementers should review some rules prescribed to stove producers concerning stoves marketing and the roles of producers and promoters since the study has shown problems regarding rules and division of labour that affects end-user sensitisation (Chapter 6, Section 6.3.3.1). ● Implementers need to sensitise end-users on stove purpose, handling, and performance before project implementation and conduct Controlled Cooking Tests since the study has identified gaps in this area (see Chapter 6, Sections 6.3.3.1). This also applies to Chilije case study (see Chapter 6, Section 6.5.2.6). ● Implementers need to include transformative learning in ICS project interventions since the study has shown gaps in this form of learning (see Chapter 5, Section 5.6). ● Implementers need to follow up projects once implemented in order to understand the constraints producers and end-users are facing in their various activity systems. This is because the study has shown that there were gaps in feedback loops and follow-ups. This made it difficult for producers to channel their concerns, and led to defunct groups (see Chapter 6, Sections 6.3.2.5, 6.5.2.3 and 6.5.3.1); for end-users lack of follow-ups led to abandoning of the ICS (Chapter 6, Sections 6.3.3.1 and 6.5.1.2). This also applies to Chilije case study.

	● Implementers need to establish stove price review schedules, since the study has shown that it takes a long time to review stove prices (see Chapter 6 Section 6.3.2.5 and Chapter 8, Section 8.2.1.2) and this affects stove production. This also applies to Chilije Case study. ● Implementers need to provide clear communication of the subsidy models they use to producers since the study has identified a gap in this area and it creates producer apathy in stove production. This also applies to Chilije case study. **Recommendation for the producer activity system** ● Producers need to establish consumer-financing models to allow a majority of end-users access the ICS technology since the study has shown that affordability of the ICS was problematic (Chapter 6, section 6.3.2.9) yet there were gaps identified in this type of model. **Recommendations for the end-user activity system** ● End-users should attend sensitisation meetings since the study has shown that attendance is usually low (see Chapter, Section 7.2.3).
Waziloya Makwakwa Village case study	**Recommendations for the implementer activity system** ● Implementers should work with ICS standardisation experts to establish qualification of the stove within the ICS types; this is because the study has shown a knowledge gap in thermal and combustion efficiency and increased ventilation of the ICS (see Chapter 1, Section 1.7.2.3). ● Implementers should collaborate with DoEA to promote the fixed stove type to wider communities in the country, as the study has shown that the stove offers more convenience in cooking time, saving firewood (see Chapter 4, Section 4.2.2.2), and heat retention is good (see Chapter 7, Section 7.3.6.1). The stove is also easy to modify because it is locally constructed. ● Implementers should engage and be informed from contextual analysis in the implementation of ICS projects. This is because the study has revealed lack of contextual analysis, and the problems associated with this gap (see Chapter 6, Section 6.4.1.1 and 6.7). This applies to all the case studies. **Recommendation for the stove constructor activity system** ● There is need to sensitize end-users on purpose, handling and performance of the stove; this is because the study identified a gap in these areas (see Chapter 8, Section 8.2.2.1). This also applies to all implementers. **Recommendation for the end-user activity system** ● End-users need to attend sensitisation meetings, as the study has shown that this is problematic (Chapter 6, Section 6.4.4.1, and Chapter 8, Section 8.2.2.2).
Chilije Village case study	**Recommendation for the implementer activity system** ● Implementers should establish transportation networks for stove producers in remote areas since the study has shown a gap in this area which led to stockpiling of stoves (see Chapter 6, Sections 6.3.2.5 and 6.5.2.3). ● There is need for contextualisation of promotion and sensitisation messages for specific areas since the study has shown that stove utilisation was affected by lack of contextualisation of promotion messages (see Chapter 6, Section 6.7). This also applies to Chapita case study. ● There is need for provision of proper training for trainers and follow-ups on how they are facilitating training of production groups since the study has shown that quality of stove production was in part affected by lack of training for trainers (see Chapter 6, Section 6.5.2.1). **Recommendation for the producer activity system** ● Producers need to follow the process for stove production to ensure quality stove since the study revealed that some processes were ignored (Chapter 6, Section 6.5.2.1). **Recommendations for the end-user activity system** ● End-users need to grasp the fundamental purposes for the introduction of the ICS in the area since the study has shown that one major factor constraining utilisation is the availability of firewood (see Chapter 4, Section 4.3.3.2).

Source: Jalasi, 2018

9.5 Recommendations for interventionist researchers

Box 9.1 provides insights in working with Boundary Crossing Change Laboratory Workshops (BCCLWs) and recommendations for interventionist researchers emanating from my experiences in conducting BCCLWs and my role as interventionist researcher.

Box 9.1: Insights in working with BCCLWs and recommendations for interventionist researchers

- The study has shown that the absence of one activity system in conducting Boundary Crossing Change Laboratory Workshops (BCCLWs) may affect the progression of expansive learning actions (see Appendix 14), and jeopardise transformative processes (see Chapter 7, Section 7.2) and emergence of will and volitional actions (see Chapter 8, Section 8.2.1). I therefore recommend that interventionist researchers planning to conduct BCCLWs devise plans and allocate extra time ahead of BCCLWs which they can use to conduct meetings outside BCCLWs with activity systems that are absent in workshops to bring them into the expansive learning processes.
- In working with groups with big gaps in education levels, I found it difficult to manage the timing of the sessions. I had to make sure all participants benefitted from the learning processes, accommodate, and make those that felt less knowledgeable, feel more knowledgeable by spending more time to solicit their contributions, at the same time managing those who felt more knowledgeable because of their education levels. However, this reflected power relations between the groups. Unfortunately, the less educated were the producers and end-users, who are often seen as recipients of technology and the more educated were the implementers who are seen as more knowledgeable in socio-technical transitions (see Chapter 2, Section 2.6). I therefore recommend that interventionist researchers should be cognisant of power imbalances in BCCLWs as this may affect Transformative Agency Pathways.
- In working with divergent languages in BCCLWs, I found it difficult to present some theoretical concepts in local languages in ways that I could be confident as an interventionist researcher that research participants understood the intended meanings. Despite the fact that I had tried to work out the meanings of the concepts before conducting the BCCLWs, during the actual process, I spent much time explaining and repeating ideas to make sure participants understood the learning processes, because of the non-verbal feedback I obtained from the research participants. This made the sessions longer than scheduled. I therefore recommend that interventionist researchers intending to work with divergent languages should plan enough time ahead of BCCLWs for conducting a trial session with the research participants and use the insights in the planning of the actual sessions. In addition, the comprehension level of all the languages involved should be nearly native speaker in order to avoid unnecessary meaning loss (see Section 9.7 below and Chapter 3, Section 3.11.4).
- During intensive analysis of expansive learning processes, I realised for the first time, that I was interrupting envisioning expressions of agency, especially during the questioning learning action. I had felt that it was supposed to wait for modelling solution-learning action (see Chapter 3, Figure 3.4). I therefore recommend that interventionist researchers should be very systematic and careful in responding to what may seem as diverging views from planned learning actions and allow these seemingly diverging views to take their course, while at the same time focusing on the planned learning actions.

Source: Jalasi, 2018

9.6 Innovative Extension and Communicative Methodology

The Innovative Extension and Communicative Methodology seeks to fill the existing gap – the absence of an interaction model, as indicated earlier, that can bring the key actors together and guide diffusion and implementation processes. It is developed out of the analysis of the ICS Social Technical System as reflected in the findings of this study. As such, *three things are crucial* in its application: (1) It takes the end-user into the centre in the development and design of the ICS technologies – their views, voices and needs are considered and respected by designing ICS that respect their cooking cultures. (2) It foregrounds ongoing expansive learning as an important component in the diffusion and implementation of the ICS innovation, for the uptake and utilisation of the technology. (3) It foregrounds interaction and

collaboration among all the key actors and stakeholders in the development, design, and implementation of ICS innovation.

The overall function for its application is to bridge the *social technical innovation intentions* and *socio-technical innovation uptake and utilisation.* Hence, it considers all structural elements and process elements deemed important for the implementation of the ICS project in a particular context; and develops more where applicable, or in their absence. Figure 9.3 shows diagrammatic representation of its functionality and Table 9.2 shows the methodology, its main phases and activities. This implies that the methodology may be adapted to suit particular contexts by including sub-phases and other activities.
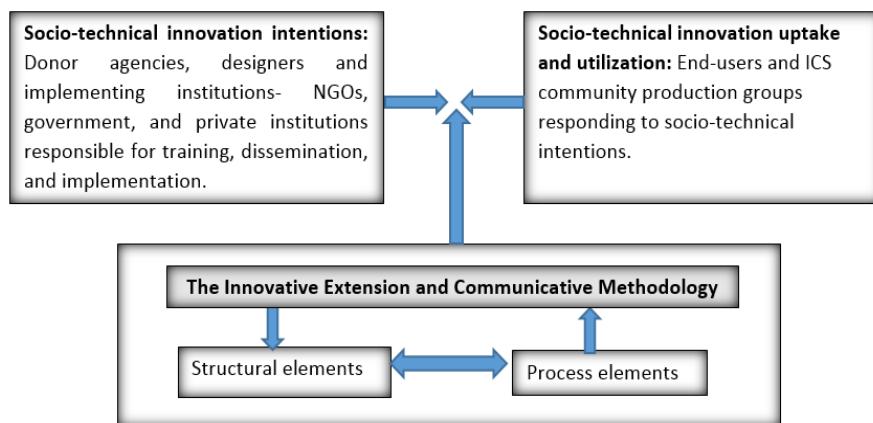
Figure 9.3: Functionality of the Innovative Extension and Communicative Methodology

Source: Jalasi, 2018

Table 9.2: The Innovative Extension and Communicative Methodology

Main Phases	Main Activities
1. Learning, training and sensitisation – before project implementation; and ongoing Expansive Learning for experimentation throughout the process	● Implementers conduct contextual analysis to learn cooking cultures, stove preferences from community members and other socio-cultural, socio-economic, environmental factors to inform ICS development, design project implementation, and funding ● End-users (community members), Village Development Committees (VDC) and Village Chiefs are sensitised on purpose of ICS by implementing institutions together with the proposed *Energy Extension Officer* ● End-users are briefed on the stages of project implementation and their required roles and responsibilities in the project
2. Designing ICSs – including Expansive Learning and experimentation throughout the process	● End-users choose at least three types of ICS designs suitable for their cooking cultures and their socio-economic needs ● Implementers are free to propose their designs, but should take suggestions from end-users for redesigning the stoves ● Implementers work with designers and the end-users in stove designs to come up with the selected stove designs
3. Cooking trials and Laboratory experimentation and Expansive Learning processes	● End-users are trained on stove handling for each stove type ● Implementers conduct cooking demonstrations for each stove type ● End-users experiment on new stove designs in real-life situations for at least a month and provide feedback to implementers

		● End-users choose the stove design (s) they want basing on their experiences with the stoves ● Implementers and designers conduct laboratory experiments to meet scientific requirements and technical principles of ICSs ● Implementers and designers modify stoves based on the feedback from end-users and laboratory tests results ● Implementers train local production groups on the selected stove design
4.	Implementation and ongoing questioning and Expansive Learning processes	● End-users are trained in stove handling of the new stove design ● Implementers conduct cooking demonstrations ● End-users experiment on new stoves and provide feedback to implementers on convenience, speed in cooking and stove durability and other related issues. Stove modifications are done if necessary.
5.	Follow ups focusing on reflective talk, and modes of communication and collaboration as well as ongoing Expansive Learning processes	● Implementers conduct follow-ups on stove uptake and utilisation at least six months after implementation and receive feedback from end-users ● Implementers review feedback obtained and address all areas of concern ● Implementers make modifications basing on feedback received or introduce new designs if necessary. This will require following some of the activities in phases 2-5. ● Follow-ups continue with the *Energy Extension Officers* after projects phase out. In the absence of the Energy Extension Officers, the Village Development Committee takes responsibility to follow up on the uptake and utilisation of the ICS in the community. ● The Energy Extension Officers report at the National Cook Stove Steering Committee meetings and Alternative Energy Section at the DoEA on the progress of ICS projects in their area, ICS uptake, and more importantly utilization

Source: Jalasi, 2018

9.7 Limitations of the study

As the study has shown, the first phase included three case studies. The idea was to continue with all of them into the second phase. However, this was not possible due to financial constraints (see Chapter 3, Section 3.6.1.3). I plan to conduct expansive learning processes in this case study as part of post-doctoral work, which I will use as another data set to inform the theoretical insights emanating from using Sannino's (2015a) Vygotskian Double Stimulation Model as indicated above. Despite this limitation, working with two case studies in the expansive learning phase allowed me to engage in an intensive analysis of the expansive learning process, which is one of the strengths of this study within CHAT work, and Expansive Learning analyses involving large data sets. This type of analysis demands time and rigour, more so when one is working with data that is produced in multiple languages with a requirement to translate into English for academic communication purposes.

As pointed out in Chapter 3, Section 3.8.1, I worked with three languages. This had two main implications: the first was that I had to translate participants' responses and contributions from source languages to English. This may result in some meaning loss, especially in capturing the cultural symbolisms in English. However, due to my experience in translation theory and practice, I worked to minimise this and made sure that I captured the essence of the meanings. As such, the cited quotes represent the intended views

and meanings of the participants. Another implication was time limitations to translate all transcripts into English due to the huge amount of data I collected (see Chapter 3, Section 3.7). Hence, the original transcripts are in their original languages (see Appendix 26).

9.8 Conclusion

This chapter has reviewed the work accomplished in the study. The study has discussed the problems in the uptake and utilisation of Improved Cook Stove (ICS) socio-technical innovations in the three case studies of Chapita, Waziloya Makwakwa and Chilije, including factors that promote both uptake and utilisation of the technology. It has discussed how actors in the ICS innovation are learning the technology. The study discussed contradictions identified within the learning, uptake and utilisation of the technology. These contradictions informed the expansive learning processes conducted in Chapita and Waziloya Makwakwa case studies. The study has bridged the theory-practice gap through change-oriented-learning processes that emphasised horizontal learning among actors in the diffusion and implementation of ICS socio-technical innovations and mobilised their agency for transformation of the ICS practice.

The chapter has discussed key findings and contribution to new knowledge in three main areas: socio-technical transitions and climate change mitigation and adaptation, community education and theories and methodologies and made recommendations related to these key findings for scholars, practitioners, and further research in these areas. What seem to be an overarching recommendation is the shift in the power dynamics in socio-technical transitions among all actors, which can necessitate the functionality of the ICS Social Technical System to make tangible progress in climate change mitigation and adaptation efforts.

Finally, I conclude that, as I embarked on an emancipatory and transformative journey that started with the plight of women in the cooking activity, the contradictions experienced in the kitchen and the conflict of motives experienced in trying to resolve the contradictions, it had seemed that the path through to transformation of the ICS practice might be impossible. As I conclude the journey, I can humbly say that transformation of the practice is possible – and this is **my contribution to new knowledge:**

This study has found out that *putting the agency of the end-user in the centre in socio-technical transitions through context-based problem resolution and rigorous deliberate[41] mediated processes of participation and learning, which allows multi-voicedness and takes power relations into account, catalyses transformative agency, reflexivity, collaboration and learning capacity of ICS actors for sustained uptake and utilisation of the ICS socio-technical innovation.* In this study, the ICS practice has served as an

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[41] Deliberate means: consciously, intentionally, carefully and unhurried facilitation of learning processes.

example of various socio-technical innovations and development projects in which top-down dissemination approaches are a predominant characteristic (see Chapter 2, Section 2.6). Putting the agency of end-users in the centre, in the development and diffusion processes as employed in this study, can significantly contribute to the sustainability of a wide range of development projects globally.

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APPENDICES

All appendices can be found on the Flash Disk that accompanies this thesis.