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

KEY FINDINGS

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Outline of presentation

- A note on the title
- Brief description of research context and problems investigated
- Brief description of the methodology and theories employed
- Key findings from first phase
- Key findings from second phase
- Recommendations for further work and adoption of new methodology in the dissemination of ICSs as a socio-technical innovation

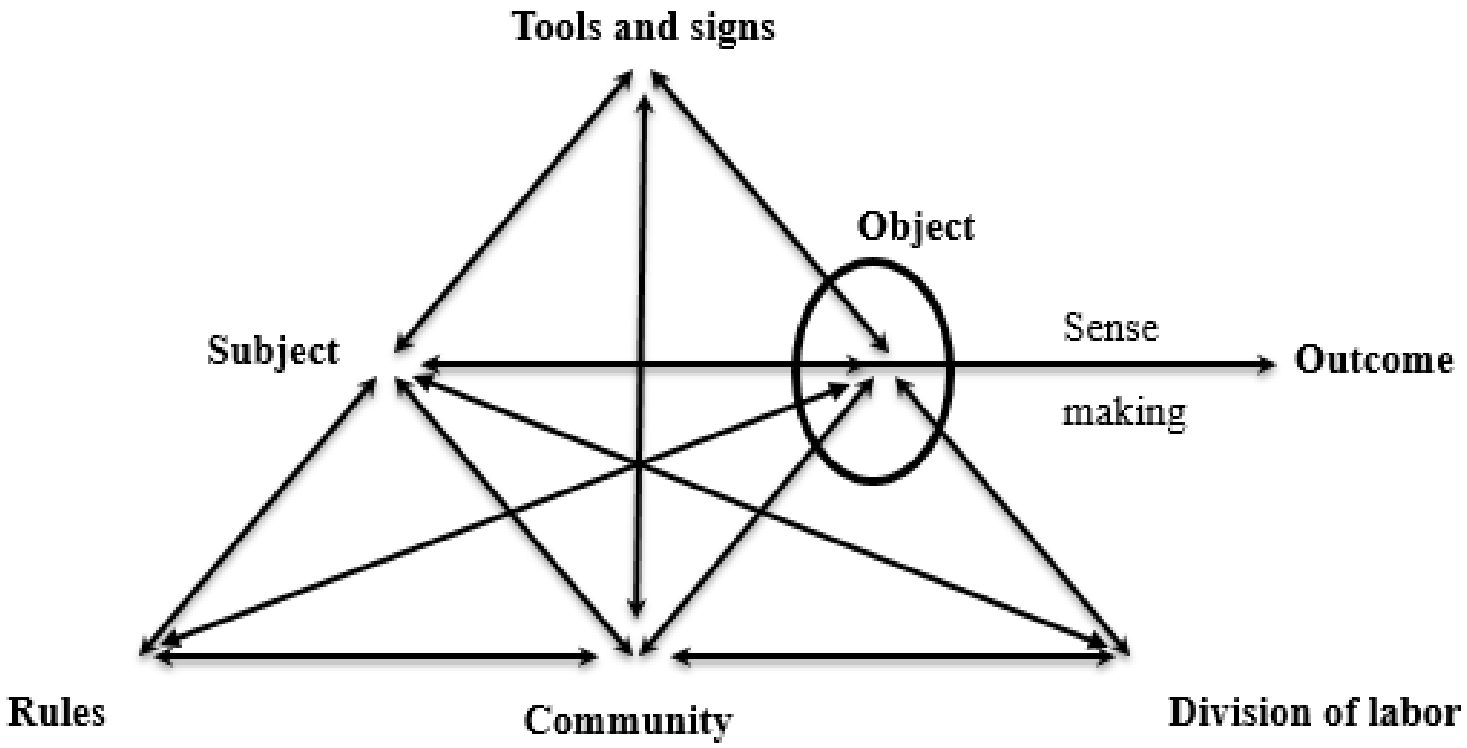
❖A note on the title

- Investigating learning: an in depth understanding of the type of learning taking place among actors working with ICS technology, including (***who*** is learning, ***what*** are they learning and ***HOW*** are actors learning the ICS technology)
- Expanding learning: enhancing learning interactions and reflexivity; evoking, mobilising, and supporting transformative agency in and among actors necessary to seek and find novel solutions to problematic situations
- The focus on learning, the approach taken in this study was based on the seminal findings of Vygotsky's work and idea that 'learning leads development' (Vygotsky, 1978, p. 90) and the elaboration by Engeström that learning can shape the evolution of new human activity in open systems (Engeström, 2015).
- Boundaries may be barriers to learning as well as "spaces" with the potential for learning (Akkerman & Bakker, 2011)

• In third generation Cultural Historical Activity Theory, boundaries are conceptualized as contradictions between two or more activity systems & are seen as vital forces for change and development (Roth & Lee, 2007, p. 203)

- *"Sustained"* use, in this study means using the ICS exclusively for all dishes; in similar ways communities use the TSF for as long as the ICS is in functioning condition.
- Activity System

The structure of second-generation human activity system (Engeström, 1987, p.78)



Research Context and Problems investigated

NGOs and ICSs investigated

Concern Universal Balaka & Dedza- Chitetezo mbaula

Catholic Development Commission in Malawi (CADECOM)- Basic fixed chimney mud cookstove

- In 2014 in preparation for the study, I conducted a contextual profile in Mulanje, Balaka, Dedza, Phalombe, Mzimba and Lilongwe

- It involved observations, interviews and document analysis

- It involved project implementers (Concern Universal, CADECOM, Africare, Mulanje Mountain Conservation Trust & Christian Aid)

- It involved stove producers and potential stove users from seven districts

- It involved policy makers (Department of Energy Affairs & the secretariat to the National Cook Stove Steering Committee)

- Contextual profile revealed the following problems:

1. Sustained uptake and especially utilization of ICS was problematic

- ❖"Fuel stacking" was evident – a phenomenon where people may acquire new cooking technologies and fuels, but will rarely abandon even the most traditional systems (Masera et al., 2000).

- ❖Fuel stacking is common not only in Malawi, but also among communities trying to adopt different types of ICSs in most developing countries (ESMAP, 2015; Rehfuess et al., 2014).

- ❖For instance in Mulanje, Balaka, Dedza and Phalombe districts, it was observed that
  - ➢ Many households visited were using Three Stone Fire (TSF) while an Improved Cook Stove (ICS), also found in the household, remained idle.
  - ➢Some households had abandoned the ICSs after first use. This was particularly the case with the portable Chitetezo Mbaula, almost a baseline ICS in the country

2. Limited technological innovation systems approaches to ICS development and diffusion in the country.

- 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" (Bergek, et al. 2008, p. 408)

- The STS approach emphasises that both developers and users influence innovation and diffusion processes and that technological change depends on some degree of social change (Atteridge, et al., 2013, p. 2).

- Technological innovations development and diffusion processes require bringing into focus the interplay between structural and process elements (Atteridge et al., 2013).

Technological innovation systems- structural elements

Element	Description
Actors	People and institutions working in and with the innovation
Rules/institutions	Rules/institutions may range from legislation to cultural norms to policy initiatives. They delineate what actors can and should do and how they interact in networks and use the materials and technical elements
Material and technical features	Physical artefacts, such as infrastructure, equipment and natural resources.

Key processes underpinning systems of technology development and diffusion

Process	Description
Knowledge development and diffusion	Deepening and broadening the knowledge base in the sector….
Setting strategies, directions and goals	The provision of incentives for actors to enter the sector and to direct their activities towards certain developments….
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….
Resource mobilization	The mobilisation of different resources….

- The problem in Malawi is, 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 profile revealed that potential stove users have mostly been on the periphery of the development and diffusion activities

- Efforts appear to be concentrated on producers of the technology.

- Also, some rules or institutions are weak or absent. The same applies to materials and technical elements. 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 (Chaonamwene, 2016).

  - 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 on how to conduct diffusion processes in communities.

❖ Additionally, the ICS industry has focused in a limited way on some process elements. For example:

➢ Market formation:

- the contextual profile revealed problems in stove marketing.

- Rural distribution networks- are almost non-existent or ineffective (GoM, 2014).

✓ Resulting into defunct projects; in some places, without the knowledge of the implementing institution.

✓ and in some places rural production groups are left with no storage space, as a result stoves are damaged.

3. The ICS innovation system in Malawi suffers from tenuous interactions among key actors; it is fragmented, with few collaborative efforts among the actors (Chisoni, 2014; GoM, 2014).

- The tenuous interaction may have created little or no opportunity for learning, knowledge sharing, insights and experiences related to the new ICS technology.

- Yet "successful innovation requires not only different kinds of knowledge to develop among actors but also a high degree of interaction between these kinds of knowledge" (Atteridge et al., 2013, p. 6).

- The problems on uptake and utilization highlighted are faced in many ICS projects globally with few exceptions in some developing countries such as 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)

- Literature reveals three dominant ICS dissemination approaches globally (1) centralised service delivery/ expert-led (2) participatory approaches/ context-responsive (3) market-based approaches.

- It reveals that top-down approaches are a predominant characteristic running through the three dominant approaches (Sesan, 2014, pp. 14-15; Honkalaskar et al., 2013, p. 3; Parfitt, 2004, p. 539; Troncoso et al., 2011; Ruiz-Mercado & Masera, 2015).

- Literature reveals 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).

- ❖However, literature reveals that the 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, Malawi, etc.) but have failed to facilitate "sustained" utilisation in most programmes globally.

- ❖Literature reveals that most of the learning embedded in the awareness raising is informative rather than transformative learning and that in some projects raising awareness is a once-off activity, especially community level awareness.

- ❖It reveals the absence of learning oriented approaches to ICS innovation dissemination that focus on enhancing reflexivity and evoking and supporting transformative agency and enhancing interaction among key actors after project initiation and throughout the dissemination processes

Methodology and Theories

Brief Description of Case studies

- The study was conducted in three climate change hotspot districts from the three regions of Malawi (Southern, Central and Northern) in

  - Balaka district- Chapita Village case study

  - Dedza district- Chilije Village case study

  - Mzimba district- Waziloya Makwakwa Village case study

Study Design

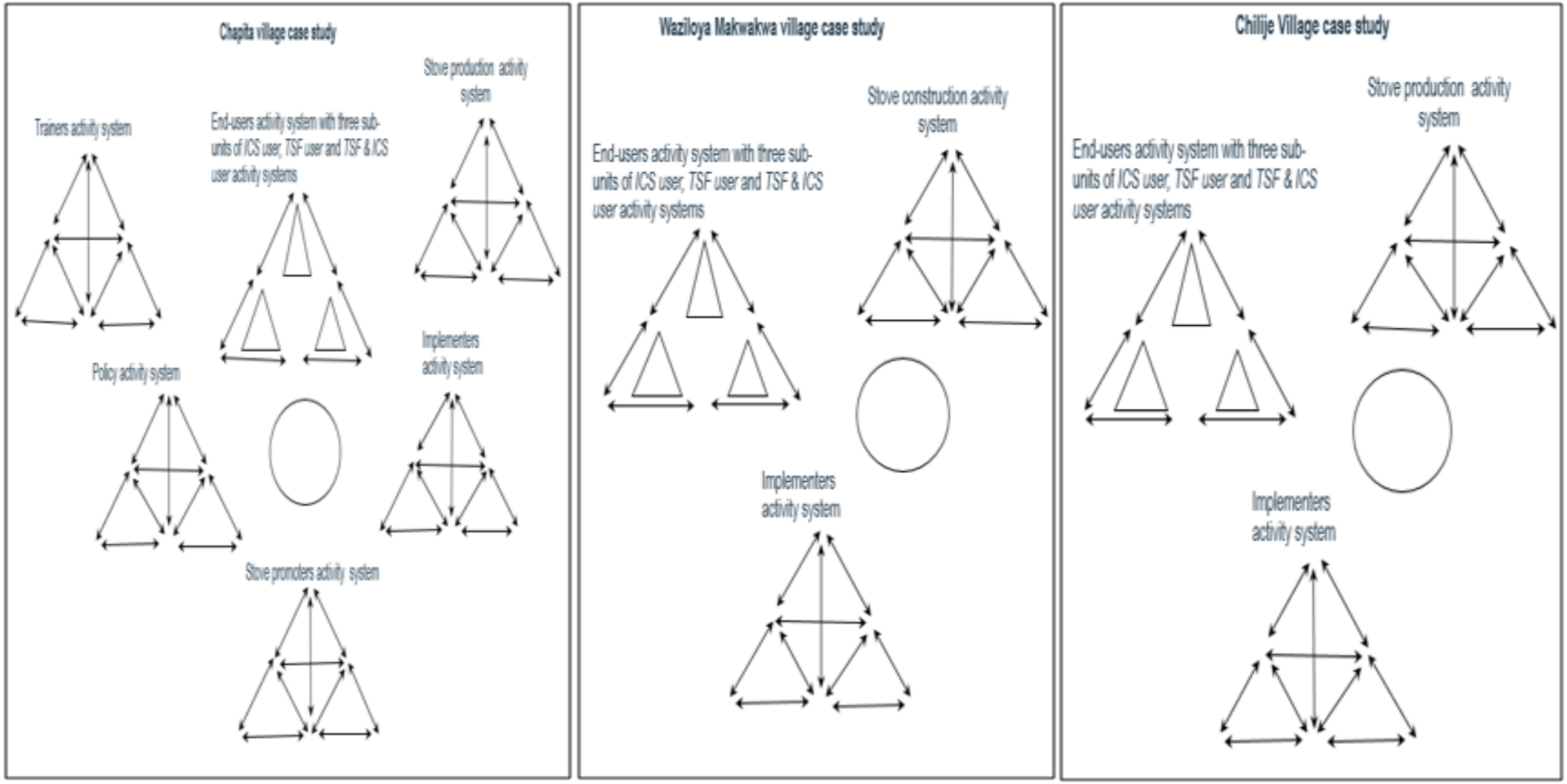
❖The study used **Formative Interventionist Approach**

➢ Formative interventions focus on supporting the actors to manage the challenges they are facing and work out the problematic situations in their joint activity (Sannino, Engeström & Lemos, 2016; Engeström & Sannino, 2011).

❖The study employed qualitative intensive research design aimed at in-depth understanding of uptake and utilization of ICSs

❖It employed multiple embedded case study design

Multiple embedded case study design employed in the study



Phases of the interventionist research design

Phase 1: Exploratory phase

- Involved extensive ethnography to gain a more deep understanding of the context of the problem and grasping the dominant existing learning approaches among key actors.

- Involved identifying and analysing contradictions in the uptake and utilization of ICSs

- Methods used included: Document analysis, group & individual semi-structured interviews & observations

  - Observations were useful in discovering whether people do what they say they do or behave in the way they claim to behave (Bell and Waters, 2014)
  - And to tap into chaotic, non-rational behaviour that would be less likely to be disclosed in an interview (McKeganey et al., as cited in Bloor & Wood, 2006, p. 71).

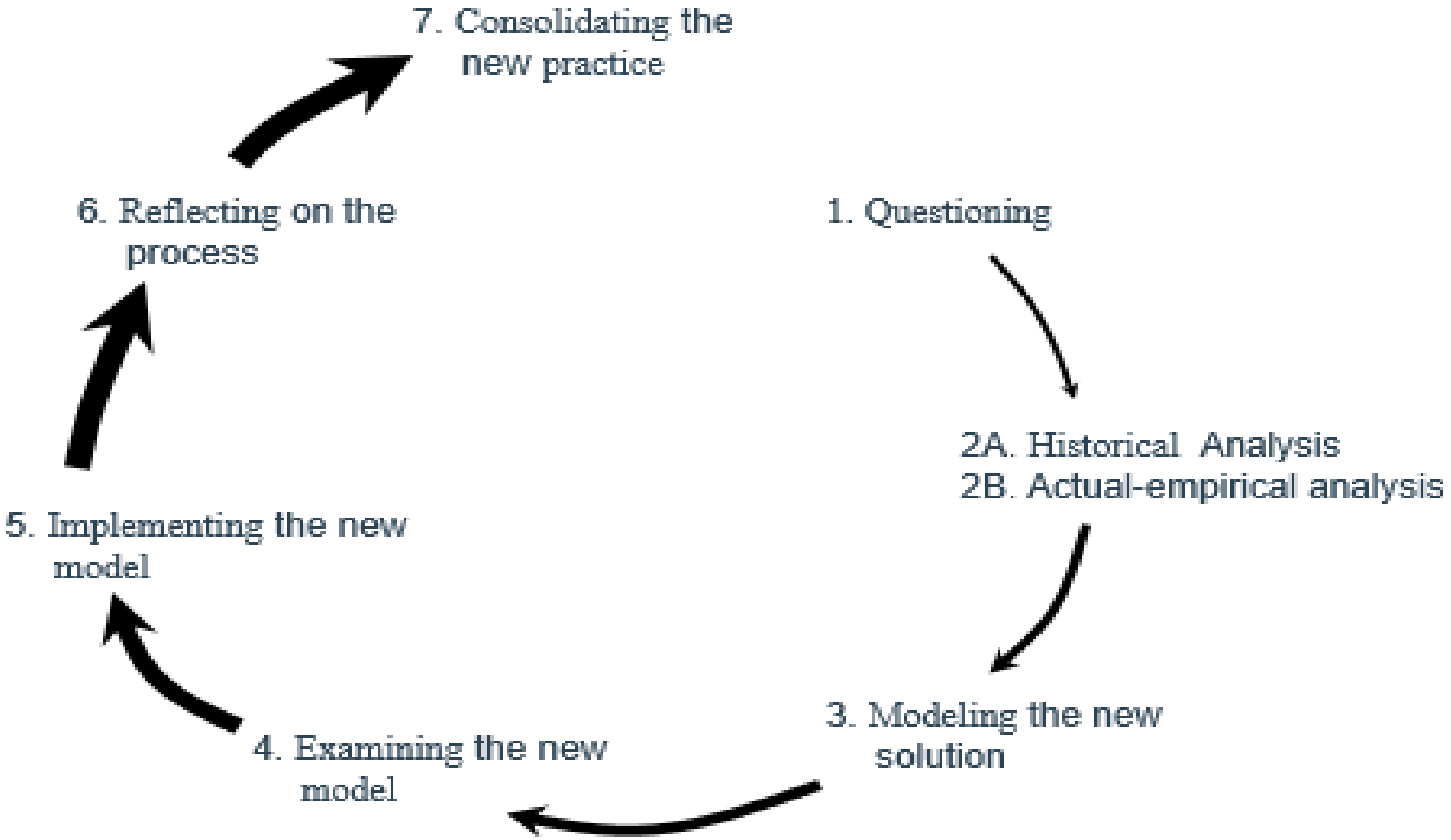
Phase 2: Expansive learning

- ❖ Focused on expansive learning processes in the Chapita and Waziloya Makwakwa case studies.
- ➢ Involved enhancing interactions among key actors
- ➢ Enhancement of reflexivity and mobilization of transformative agency among actors in order to
- ➢ Resolve some of the contradictions identified (finding locally appropriate solutions) and implementing them

- ❖ Methods used included: observations, group discussions and Boundary Crossing Change Laboratory Workshops (BCCLW)

- ❖ BCCLW was the main methodology employed in the second phase to carry out the **cycle of expansive learning actions** in Chapita and Waziloya Makwakwa case studies

Sequence of epistemic actions in the Expansive Learning Cycle (Engeström, 1999b, p. 384)



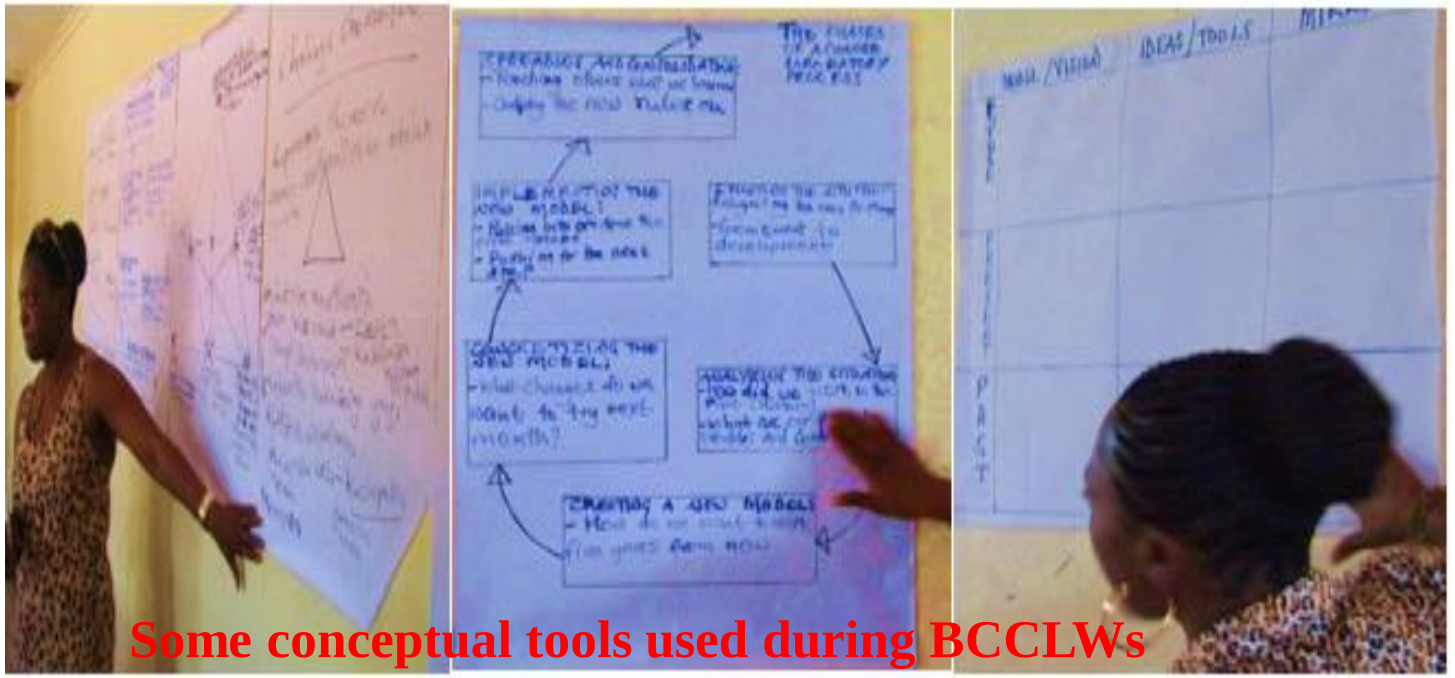
- ❖BCCLW was a useful method to work with actors in the ICS practice towards the transformation of the practice, through finding new ways of working

- ❖Through BCCLWs, I brought together practitioners from interacting activity systems to stimulate them to analyse the history, contradictions and Zone of Proximal Development (ZPD) of their activity system, to design a new model for it; and take steps towards the implementation of the model (Engeström, 2015)

BCCLW in Chapita Village case study

BCCLW in Waziloya Makwakwa Village case study

Participants synchronise action plans in Waziloya Makwakwa case study



Some conceptual tools used during BCCLWs

Participants develop action plans in groups in Chapita

Theories

- I used Cultural Historical Activity Theory (CHAT) and Critical Realism (CR) because both focus on learning as emancipatory process and transformation of human practices by evoking agency and reflexivity of the actors involved.

- I used Expansive Learning theory / and or Developmental Work Research to guide the expansive learning processes as it focuses on change-oriented learning.

Findings from Phase 1

Profile of uptake and utilization of ICSs

- 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 owned an ICS in Waziloya Makwakwa utilised the stove
  - It appeared that they were not using the ICS in combination with TSF.
  - This appeared to be due to the stove design, which has three cooking places and one place for loading firewood and offers convenience through time-saving aspects (cooking time and firewood collection time), which were identified as major reasons for sustained utilisation of ICS in the case study

- ***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 technologies available.

- The findings on the profile of uptake and utilisation in Chapita and Chilije village case studies resonate with the national level views. That at national level uptake was not a challenge, but utilisation was a challenge.

- The Chitetezo Mbaula was the stove available in the two case studies, the baseline ICS promoted nationally

- This appears to imply that end-users using Chitetezo Mbaula may be facing similar problematic situations at national level, particularly in using the ICS

- The findings indicate that informative rather than transformative learning was mainly taking place in the case studies

- The informative learning was also inadequate especially for end-users (interlinked with overreliance on poverty-targeted donor driven projects)
  - This inadequacy was also due to tenuous interactions identified among key actors which are usually once-off (predominantly in Chapita & Chilije case studies)
- In all the three case studies the learning interactions identified were unidirectional

- The directionality of the learning interactions indicated that the implementers were not learning from the other activity systems in **all** the three case studies

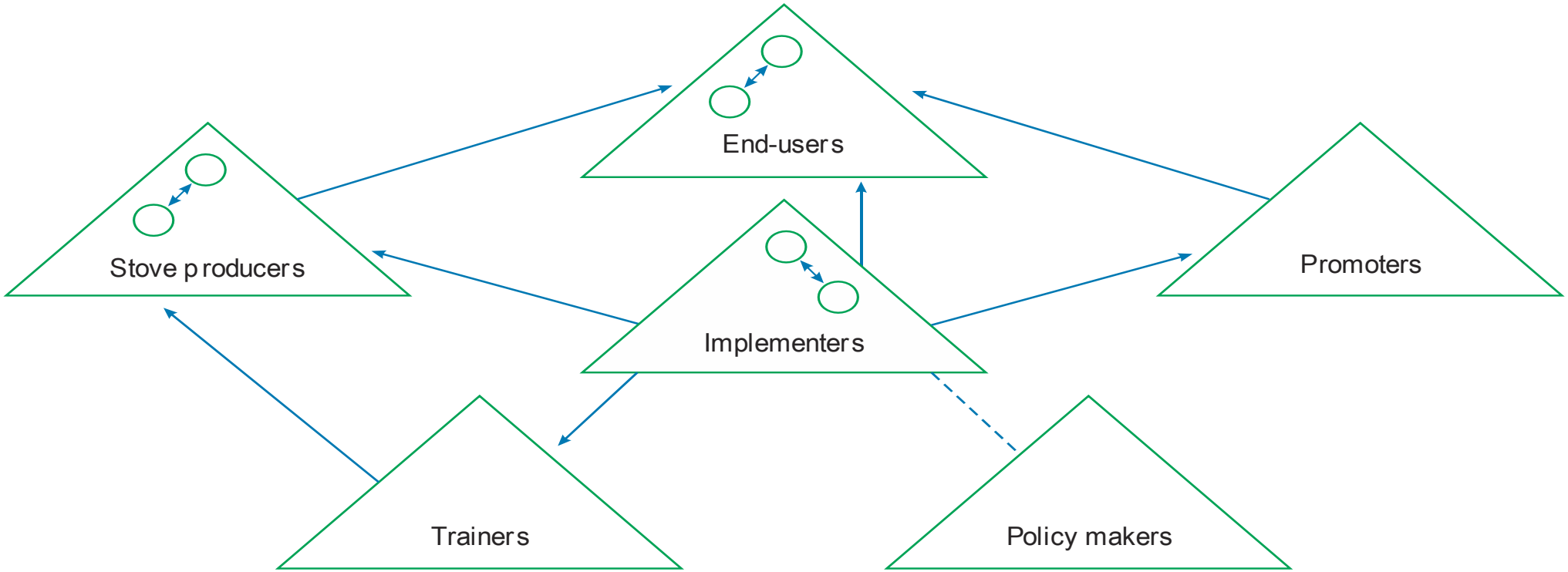
  - This finding illustrates the prevalence of the top-down approaches in ICS dissemination

- ❖ The learning interactions appeared 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 Chapita & Chilije case studies is in fact “a breach of the rules” prescribed for the producer

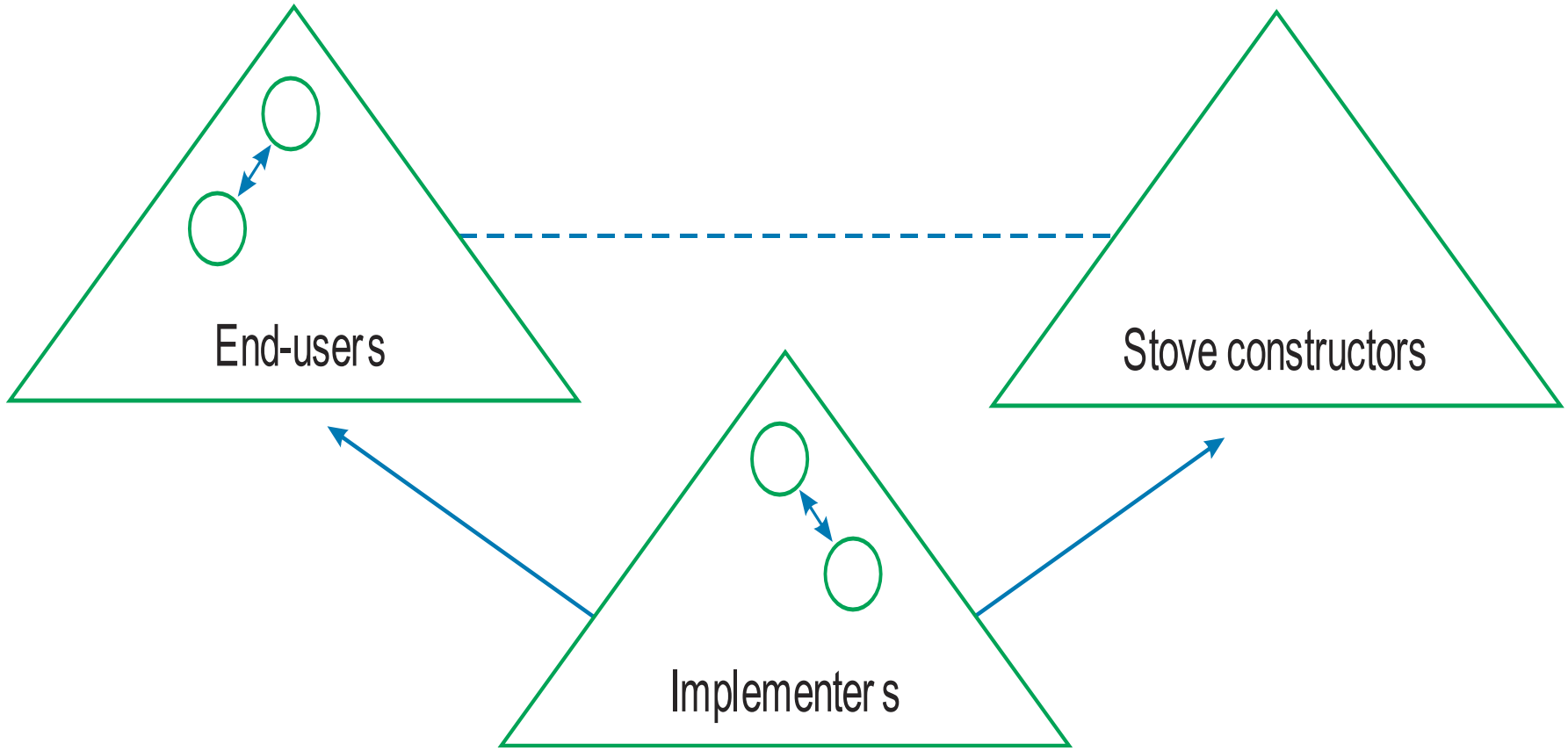
- ❖ Much of what subjects learn and how they learn is shaped by the different roles their activity systems play in the ICS practice

Existing interactions and learning interactions among cook stove actors in Chapita Village case study

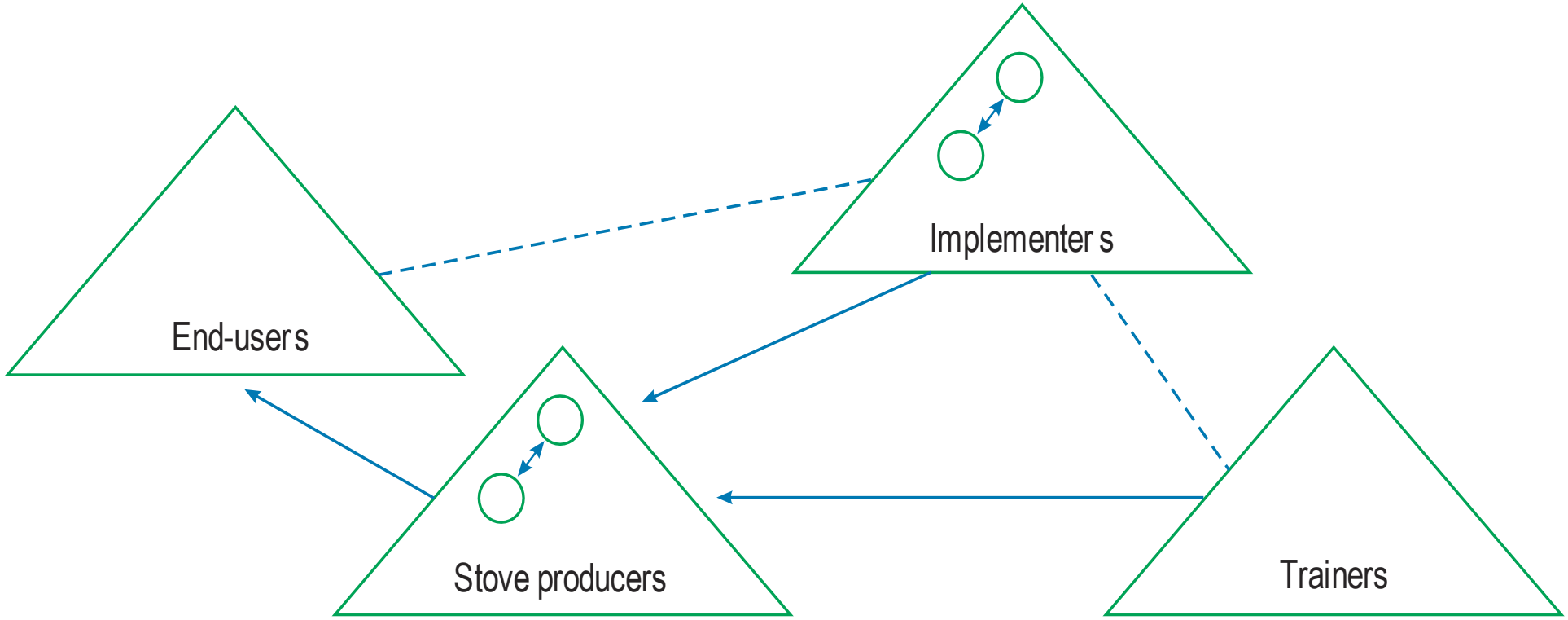


- The connected cycles within the triangles indicate learning interaction between subjects of an activity system.
- The arrows identify the learning subject in each interaction.
- The dotted lines indicate interaction and solid arrows indicate learning interactions

Existing interactions and learning interactions among cook stove actors in Waziloya Makwakwa Village case study



Existing interactions and learning interactions among cook stove actors in Chilije Village case study



- **Contradictions** exist in the uptake, utilization and learning of ICS technology in all the three case studies

- The contradictions constrain the uptake, utilization and learning of ICSs

- Examples of contradictions identified in the Chapita case study constraining utilization of Chitetezo Mbaula:

Contradiction 1: Satisfying the requirements for firewood saving and heat retention *versus* delaying cooking/ (no speed in cooking)

Contradiction 2: The need to use an improved cook stove to save firewood *versus* struggling to cook nsima (maize based staple food) on the improved cook stove (stemming from stove design)

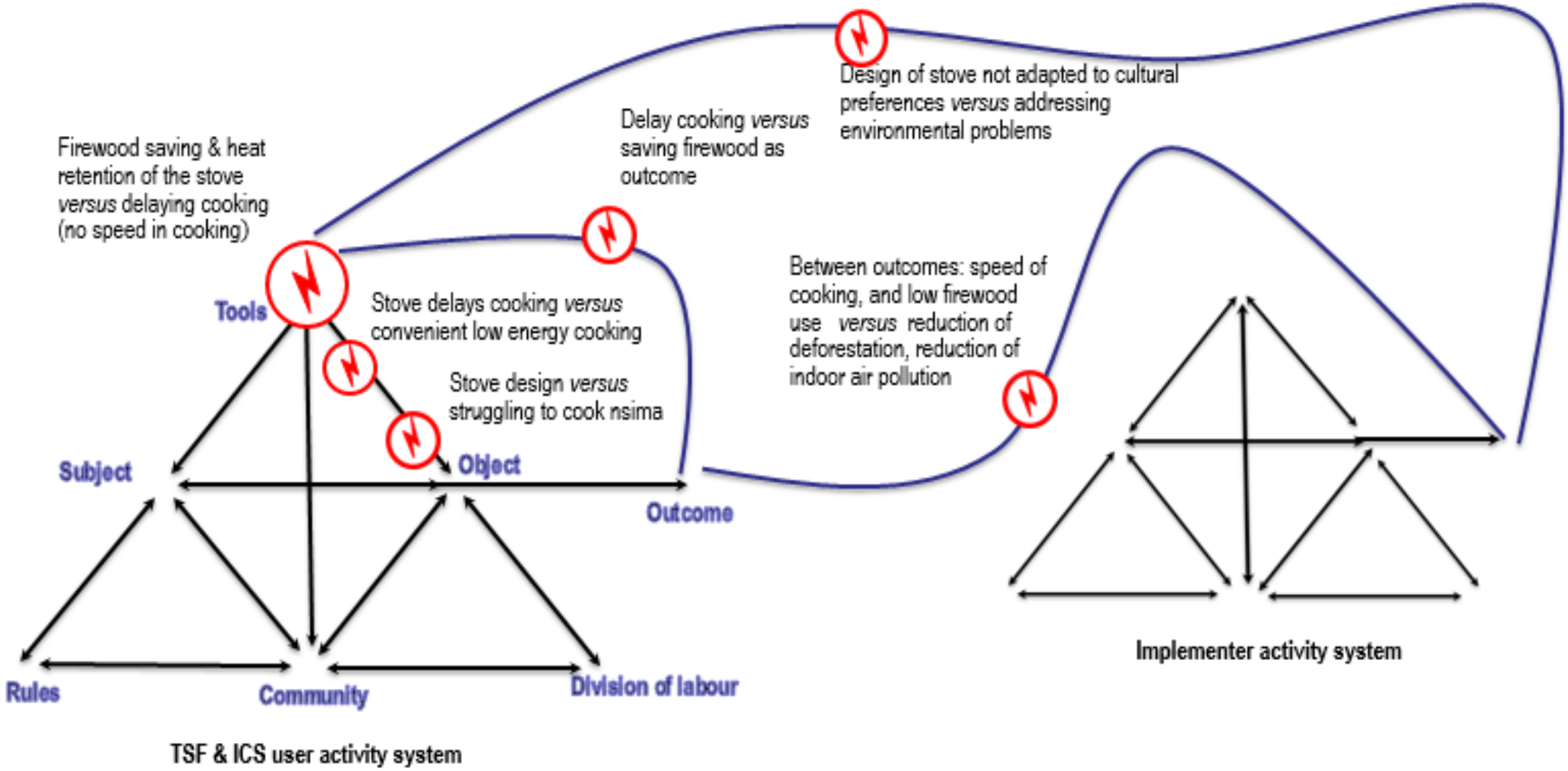
Illustration: Satisfying the requirements for firewood saving and heat retention *versus* delaying cooking/ (no speed in cooking)

- ***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)

- ***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)

- ***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.* (Consultation meeting BCCLW # BK6)

Contradictions within the TSF & ICS activity system in Chapita Village case study



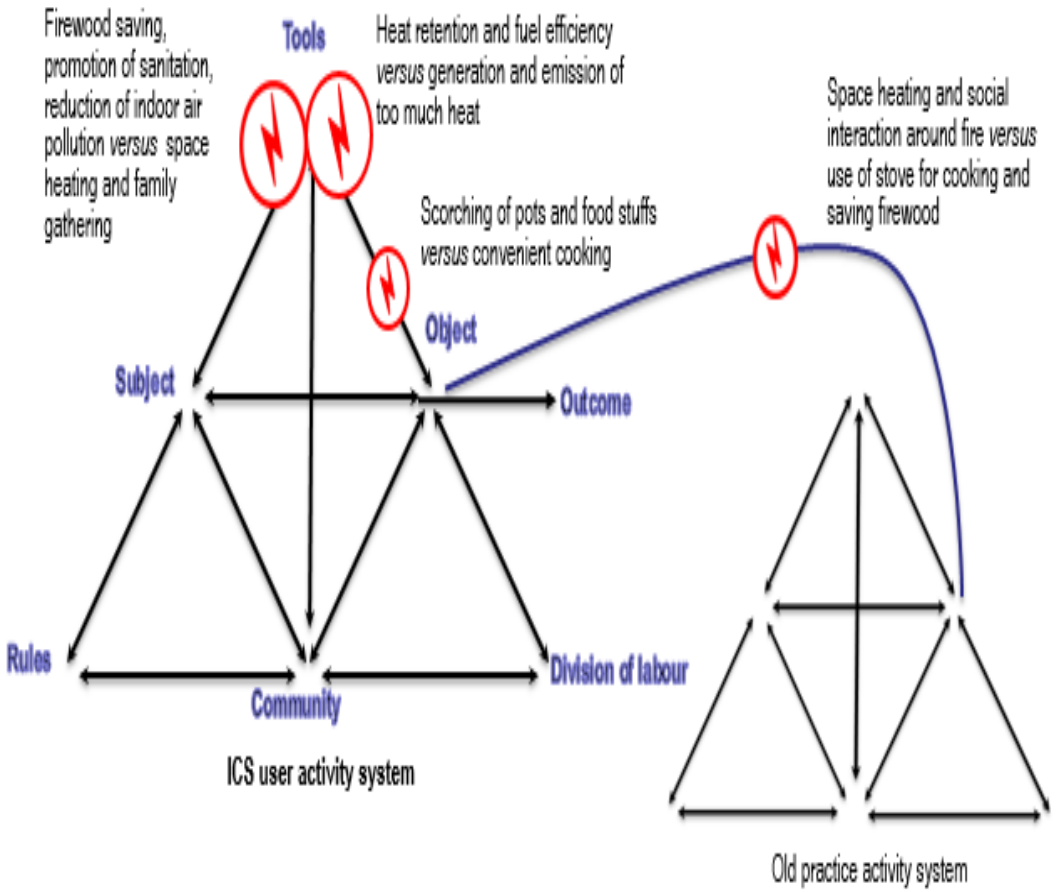
❖Examples of contradictions identified in Waziloya Makwakwa case study constraining uptake and utilization the fixed stove

Contradiction 1: The need for heat retention to achieve the requirement for fuel efficiency *versus* generation and emission of too much heat

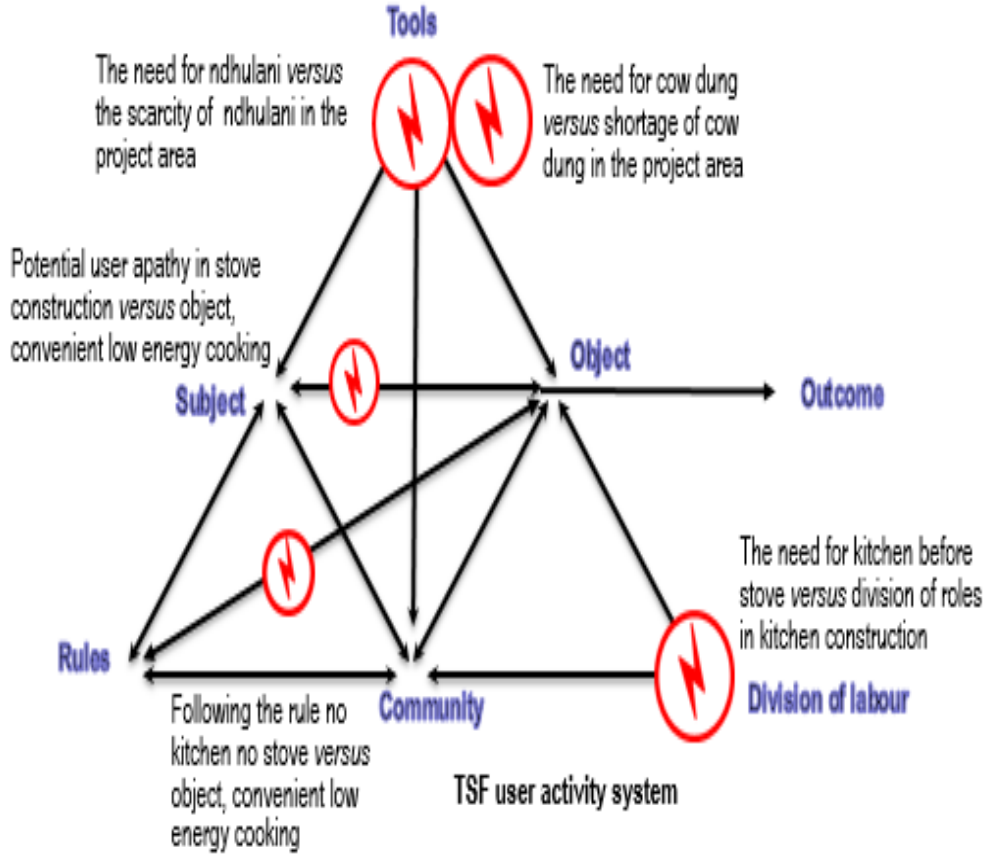
Contradiction 2: The need for ndhulani, a stove construction material responsible for durability of the stove *versus* the scarcity of the material in the project area

Contradictions within two activity systems in Waziloya Makwakwa case study

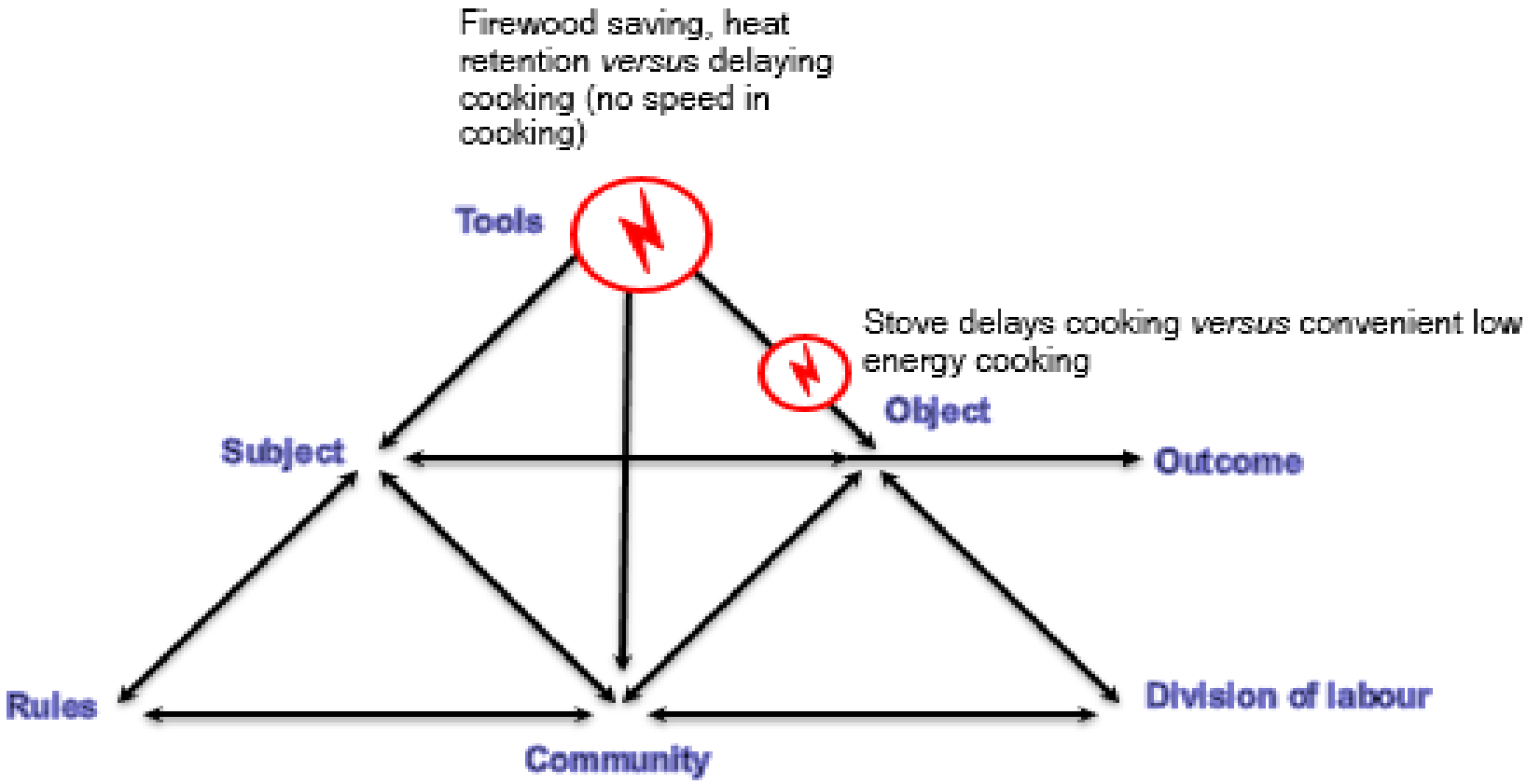
Contradictions within ICS activity system



Contradictions within the TSF user activity system



Contradictions within the TSF & ICS user activity system in Chilije Village case study



TSF & ICS user activity system

Some causal mechanisms influencing contradictions across case studies

1. Poverty

- 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 ICS practice
- The situation culminates in prescribing how projects are carried out, including duration & outcomes that satisfy the objectives of the funders
- This seems to put pressure on ICS implementing NGOs to satisfy donor requirements and it encourages top-down approaches adopted by implementing institutions
- The implications are that, for example:

- Lack of consideration on the requirements for the facilitation of learning of the technology amongst end-users
- Overlooking of process elements, for example, comprehensive research and development on the technology under development that includes adequate socio-cultural understandings of contextual and cultural cooking practices.

❖ To illustrate this point:

- 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

- ***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…"* (Interview, June 12, 2015)

2. Successful-project-syndrome

- 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.

- For example: 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.

❖ The identification of contradictions in the learning, uptake and utilisation of ICS provided a need to carry out BCCLW and expansive learning **(in phase 2)** order to resolve them

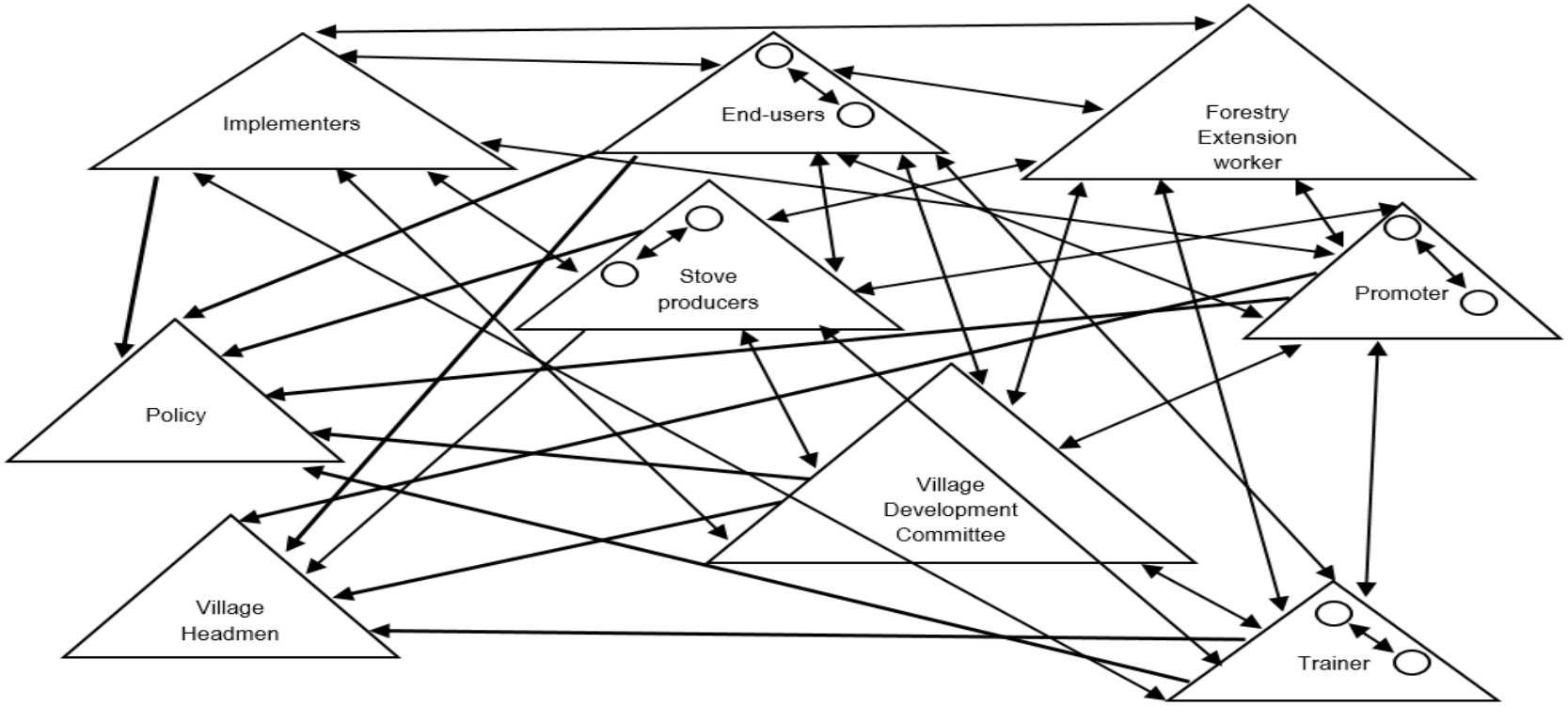
Findings from Phase 2: Expansive Learning

1. **Learning interactions enhanced**

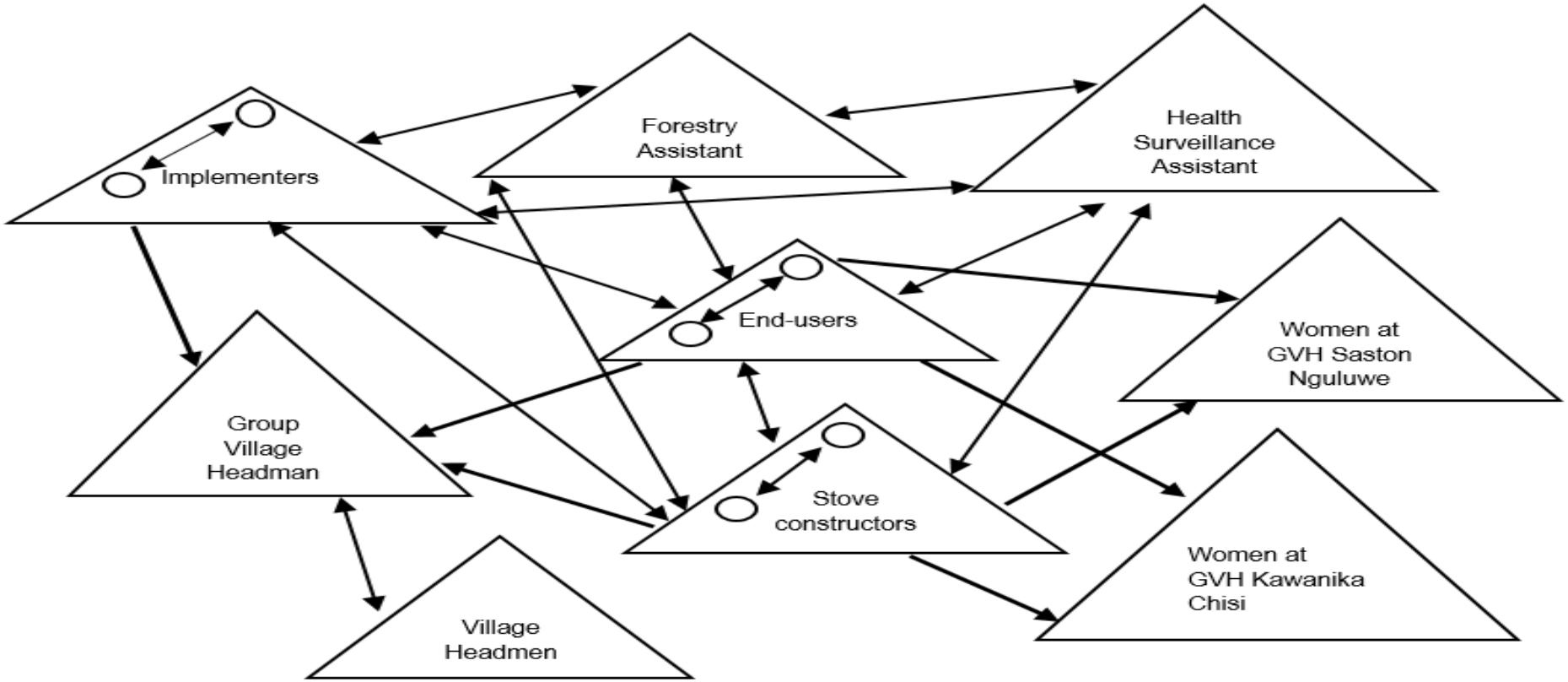
Expanded learning interactions in Chapita Village Case studies

❖Notice the shift in directionality of learning interaction from unidirectionality to bi-directionality

❖The increase of activity systems taking active roles in the ICS practice



Expanded learning interactions in Waziloya Makwakwa Village Case studies



2. Reflexivity and transformative agency evoked, enhanced and supported

❖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)

❖**Reflective talk: Examining one's practice in order to change it and Transformative agency: '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)

❖**Taking consequential actions to change the activity:**

- Participants concretised the agency and experimented cooking *nsima* with support using a 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 Appendix 13, Video clip MV1_00012.MOV.)

Example of a contradiction resolved: Cooking nsima with tree fork support

Video still showing the transitions in cooking nsima with tree fork support

Example of contradiction resolved: Reduced heat generation-reduced amount of cow dung and increased size of fire distribution holes inside the ICS

New stoves constructed with new materials, measurements, and dimensions *(Chisoni, June 2016b)*

Major conclusions from the Expansive Learning processes

❖Contradictions play a key role in ICS end-users' learning

❖Expansive learning processes conducted in the Chapita & Waziloya Makwakwa reveal:

➢ Their potential for the diffusion and adoption of the ICS innovation

➢ Their potential in enhancing interaction among ICS actors, enhancing reflexivity and mobilizing and supporting transformative agency necessary for uptake and more importantly sustained utilization of the ICS innovation

❖ Mobilisation of agency and scaling was easier at the grassroots level where less boundary-crossing was needed but more difficult at other levels of the system that required more boundary-crossing due to the multi-stakeholder multi-level ICS Social Technical System.

Transformative Agency Pathways illustrating the difficulty in agency mobilisation at the national-international boundaries of the ICS socio-technical system

Moving forward……..

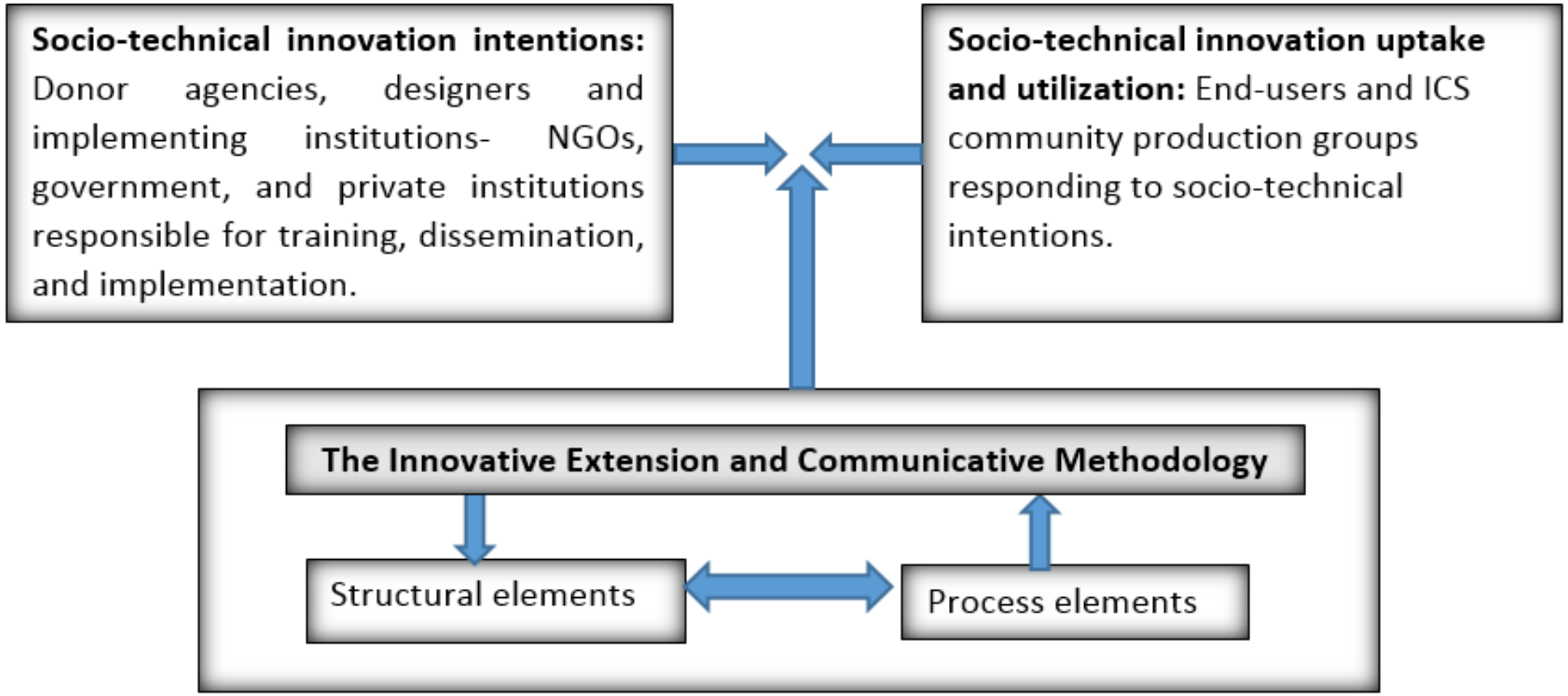
- I recommend conducting a series of BCCLWs with national- international stakeholders (through the DoEA & NCSSC) to find ways of concluding the remaining Transformative Agency Pathways

- I have also made case-based recommendations, specific for each activity system

- I recommend for the adoption of the the *Innovative Extension and Communicative Methodology* that I developed from the study for the diffusion and adoption of the ICS as a socio-technical innovation

- The methodology aims at promoting interactions and learning at the intersection between the promoters' intentions and the users' adoption, and structural and process elements deemed necessary in specific contexts

An Overview of the Functionality of the Innovative Extension and Communicative Methodology



Innovative Extension and Communicative Methodology

1. It takes the end-user into the centre in the development and design of the ICS technologies – by considering and respecting their views, voices and needs through designing ICSs 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.

Take home message from the study

Putting end-users and their agency in the centre of socio-technical innovation transitions by means of deliberately induced expansive learning processes catalyses transformative agency, reflexivity, collaboration and learning capacity of ICS actors for sustained uptake and utilisation of the ICS socio-technical innovation.

Thank you very much for listening !!!

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