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**Farmers' views on
innovation outcomes:
participatory outcome
evaluation with
smallholder farmer groups
in Tanzania**

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Table of content

LIST OF ABBREVIATIONS	3
SUMMARY	4
1. Introduction.....	5
2 Materials and Methods	6
2.1 Participating groups: innovation selection, group formation process and objectives.....	6
2.2 Selection of farmer participants and interviewees from the innovation groups.....	8
2.3 Qualitative research approach.....	8
2.4 Field work data	8
2.5 Supporting observations, interactions and tools.....	10
2.6 Participatory outcome evaluation with innovation farmer groups: techniques and activities	11
2.6.1 Most significant change technique.....	12
2.6.2 Opinion line	13
2.6.3 Outcome ranking	14
2.6.4 Feedback sessions	15
2.7 Semi-Structured Interviews (SSI)	16
2.8 Data analysis and presentation of collected field work data	16
3. RESULTS	18
3.1 Innovation group profiles and current state of innovation implementation	18
3.2 Overview of the intended innovation outcomes	21
3.3 The farmers' view on their innovation outcomes.....	23
3.3.1 Farmers' expectations of innovation outcomes	24
3.3.2 Innovation Groups' actual innovation outcomes under most frequently named outcome themes	27
3.3.3 The farmers' prioritization and valuation of innovation outcomes.....	36
3.3.4 Farmers' satisfaction regarding specific innovation outcomes	42
3.4 Farmers' perception of factors influencing innovation outcomes.....	51
3.4.1 Farmers' perception of inter-connections between innovation outcomes.....	51
3.4.2 Influence of restricting factors on innovation outcomes	52
3.5 Influence of individual farmers' age and gender on innovation outcomes	59
4 CONCLUSIONS AND RECOMMENDATIONS.....	62
5 REFERENCES INFORMING THIS STUDY	64
6 ANNEXES.....	76

LIST OF ABBREVIATIONS

AEO	Agricultural Extension Officer
ARI	Agricultural Research Institutes
CBO	Community based organizations
CL-group	Collaborative learning group
CSS	Case study site
DOS	Degree of satisfaction
DCC	Dependence on climatic conditions
FM	Forest management
FVC	Food value chain
GDP	Gross Domestic Product
GHI	Global Hunger Index
HH	Household
IG	Innovation group
KG	Kitchen garden
LEIS	Low external input system
MD	Micro-dosing
MJUMITA	a network of community based groups across Tanzania
MSC	Most Significant Change
MVIWATA	National Network of Farmers' Groups in Tanzania
OL	Opinion line
PM&E	Participatory monitoring and evaluation
POE	Participatory outcome evaluation
PPP	Purchasing Power Parity
PRA	Participatory Rural Appraisal
R&D	Research and development
RWH	Rainwater harvesting
SH	Smallholder
SHF	Smallholder farmer
SSA	Subsaharan Africa
SUA	Sokoine University of Agriculture
t&t	Tools and techniques
Trans-SEC	Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer: A people centred Approach
TZS	Tanzanian shilling
UNDP	United Nation Development Programme
UPS	Upgrading strategy

SUMMARY

Within the frame of Trans-SEC, the aims of this research were to identify farmers' views on their actual experienced innovation outcomes, as well as their views on the factors influencing these outcomes, through deployment of participatory research tools. Different innovations, intended to enhance the livelihood and/or food security situation of smallholder farmers (SHF) in two regions of Tanzania, were implemented by farmer groups located in four different villages. This study presents results from six different groups from three different villages.

Farmers categorized their various individual innovation outcomes into outcome themes, of which outcomes assigned to "Time", "Money" and "Knowledge" were important for most of the groups. Outcome domains that are based on farmers' dimensions of well-being were defined to identify the influence of outcomes on farmers' lives. It is shown that the three outcome domains "Physical", "Financial" and "Intellectual" covered most of the intended as well as the experienced outcomes of the six innovation groups.

Interestingly, the individual farmers' valuation of outcomes revealed that nearly half (48%) of the prioritized outcomes of all farmers from the six IGs are assigned to the "Intellectual" domain, which indicates that gaining knowledge is a very important issue for the farmers. They also stated to be quite satisfied with the knowledge they have already gained. Concerning outcomes assigned to the "Financial" domain, which was prioritized by a fifth of the farmers, results show that farmers are not satisfied with the financial benefits gained through the innovation implementation, which indicates that their financial resources to improve their livelihoods and improve their innovation systems remain low.

However, which and how innovation outcomes are experienced by the individual farmer is mainly dependent on their resources and socio-cultural background: what farmers experience is dependent on who they are. For instance, in the innovation process of one group, certain members, especially women and elders, were found to be practically excluded as they were unable to fulfil physically demanding tasks of the innovation process. Others were excluded from access to beneficial innovation outcomes due to their wealth status, farm location, or social capital, for example. Therefore, it is emphasized that innovation outcomes need to be contextualized and differentiated in the context of the real world situations from which they originate, by giving consideration to the details that are revealed through this study.

A vast number of restricting factors for successful innovation implementation were identified, which can be associated with four sources of influence: namely, the innovation itself; external factors; the innovation group, and; the individual farmers. It was found that the overlap of external, as well as internal factors of specific innovation systems, which influence the innovation process, made it difficult to adapt innovations to site specific conditions of SHF in order to realize intended outcomes. Farmers were highly aware of the factors restricting their innovation process. This highlights the importance of enabling farmers to participate meaningfully in the decision-making process of transdisciplinary innovation projects, to become the agents of their own innovation processes and to take advantage of the project's innovative capacity and structure.

The applied POE tools were selected to be indicator-free, to enable the farmers to elaborate their views as freely as possible and thus to learn which changes in farmers' lives matter for them and why. These participative activities supported farmers to express and formulate their needs, and offered a platform to expose them. Farmers' emphasized the importance of *knowledge* in order to successfully manage innovation processes and become the agents of their own innovation processes.

Farmers' views on innovation outcomes: participatory outcome evaluation with smallholder farmer groups in Tanzania

I. Introduction

Improving food security and livelihood conditions of vulnerable rural populations in Sub-Saharan Africa (SSA) has been an on-going challenge, particularly in light of climate change. Still nearly one-third of the Tanzanian population (16,8 million) is found to be undernourished (FAO, 2015). According to Ashley (2016), the causes of food insecurity evolve from multiple levels and multiple issues, such as environmental degradation, climate change, insufficient awareness of policy makers, interplays of poverty, or price instabilities. Innovations, appropriate to context-specific circumstances of smallholder farmers (SHF), are often intended to improve resource-poor systems to reduce poverty and increase food security (Alarcón and Bodourolou, 2011). However, the overlap of external, as well as internal factors of specific innovation systems, which influence the innovation process, make it difficult to adapt innovations to site specific conditions. Previous studies have shown that there are often divergences between scientists' and farmers' expectations of innovation outcomes (Cook, 2014; Hall et al., 2003). Further, outcomes may be experienced and interpreted differently for socially differentiated farmers (Ngwenya et al., 2015). A key problem is then how to evaluate innovation project outcomes effectively, in a way that gives voice to farmers' own (divergent) experiences and simultaneously, can allow useful comparisons between different innovations and projects.

The Trans-SEC project "Innovating pro-poor strategies to safeguard food security using technology and knowledge transfer" aims to identify and promote successful food securing upgrading strategies (UPS) and innovations along local and regional food value chains. In the frame of this transdisciplinary research project, focused on improving household food security of SHF in Tanzania, the aims of the present study are to identify farmers' views on their actual experienced innovation outcomes, as well as their views on the factors influencing these outcomes, through deployment of participatory research tools. Moreover, a comparison between farmers' views and the project's intended innovation outcomes is drawn.

The aims of this research are to identify farmers' views on their actual experienced innovation outcomes, as well as their views on the factors influencing these outcomes, and to relate these to the project's intended innovation outcomes. In this context, the following research questions are addressed with regard to six different (project-affiliated) innovation groups:

1. What were the intended outcomes of the innovations, from the perspective of the project researchers?
2. What are the farmers'
 - a. own expectations of innovation outcomes?
 - b. actually experienced innovation outcomes?
 - c. views on the value of different outcomes and reasons for this valuation?
 - d. reasons for dis/satisfaction with different outcomes?
3. What are the farmers' views regarding:
 - a. inter-connections between different outcomes?

b. factors restricting innovation outcomes?

4. What is the influence of farmers' gender and age on their innovation outcomes

2) Materials and Methods

In 2014, the Trans-SEC project established twenty-seven groups to implement more than nine different UPS across the four CSS. Three pre-existing farmer groups were also invited by DITSL participate in collaborative learning (CL-) for self-development of own innovations and are henceforth referred to as CL-groups The UPS/innovations and groups that are presented in this study are introduced below.

2.1 Participating groups: innovation selection, group formation process and objectives

Table 1: Participating innovation groups characterized by their intended main objectives and group criteria

Innovation	Group Name and location	Main Objectives	Group criteria
Improved Maize Processing	UPS No.3: Improved maize sheller machine to reduce human labour in rural contexts; Ilakala	To improve the livelihood of farmers by introducing the machinery facilities to increase the efficiency of shelling maize in their localities.	<ul style="list-style-type: none"> - Minimum of 20 farmers required for group formation - Monetary contribution of group members to purchase maize sheller (6,500,000 TZS (2688 €)¹) that will be operated in a business manner by the group
Bike rental business (and group farm)	Cl. Group: Upendo Changarawe	To run a bike rental business (for constant flow of cash) to increase group farm (African eggplant, sweet pepper) activity for income generation to improve group members' livelihood	<ul style="list-style-type: none"> - Started as outgrowth of CCM (Ruling party in Tanzania) youth organization, but the group itself is not politically motivated - Open to anyone (age, party affiliation) - Entrance fee 10 000 TZS
Rainwater harvesting (RWH) & Fertilizer micro-dosing (MD)	UPS No. 1: RWH for improving sole and intercrop yields under rain-fed farming system to SHF's productivity and welfare effects of fertilizer MD for upgrading the Maize and Millet value chains; Ilakala	To conserve soil moisture in the field and to increase crop production in sub humid areas; to reduce runoff and soil erosion for sustainable soil fertility management and crop productivity of Maize plus intercrops (sesame, legumes).	<ul style="list-style-type: none"> - Min. of 40 farmers required for group formation - Each member should be capable of allocating 1/4 acre for baby plot - The provided land should be an area with low slope and easily accessible (in all weather and with security of crops) - The soil of the land provided should be loamy with modest fertility - the land has to be suitable to grow/cultivate three crops, (maize, pigeon peas, sesame)
Water pump and training to irrigate	CL-group: Tuamiho; Ilakala	to cultivate tomato and sweet pepper on a group farm irrigated (by the use of a water pump), with the purpose of income	<ul style="list-style-type: none"> - Mjumita² initialized the group formation - Open to everyone with an interest in implementing horticultural activities

¹ All amounts stated in € are approximated values.

² MJUMITA is a network of community based groups across Tanzania which aims to improve community forest management (FM), build capacity among members and provides technical assistance regarding FM, governance and advocacy.

group farm		generation; Gaining knowledge on the use of the machinery, group management, and horticultural techniques, seed quality and fertilizer	
Improved stoves	UPS 6: Using Improved Firewood Cooking Stove and its Implications on rural livelihoods in Tanzania; Ilolo	To establish the ICS technology to reduce the pressure on fuelwood demand, improve the economy of the rural people, and ensure environmental sustainability.	<ul style="list-style-type: none"> - Min. of 30 farmers required for group formation - Members of this group must be willing and able to be trained and train others farmers in the sub villages - Members must be able to contribute costs of making stoves at their own home
HH nutrition education & Kitchen garden (KG) training	UPS No. 10: HH centered nutrition training and KGs of green leafy vegetables for improved dietary diversity and family health; Ilolo	To improve food consumption patterns, nutrient intake and dietary diversity of rural household family members.	<ul style="list-style-type: none"> - Members of this group are HHs which have children (under five years old)

Sources: elaborated from (DITSL, 2015; Fernandez, 2016; Germer et al., 2016; Lambert et al., 2014; MVIWATA, 2016; Schulz, 2016; Thapa, 2016; Uckert and Graef, 2016; Yustas et al., 2016); all are unpublished

The names of the included groups, their objectives and group criteria are stated in Table 1. A key difference between the UPS- and CL-groups is the time, purpose and frame of initial group formation. For UPS group formation, farming households were invited to opt for project-specified upgrading strategies (UPS), presented at a meeting by Trans-SEC. Guided by certain group criteria (shown in Table 1), such households were then grouped together. The CL- groups were pre-existing groups with existing group activities, which were supported by Trans-SEC in implementing their own self-defined innovations identified through a process of participatory scenario building (Schulz 2016). Among those 30 groups, the selection of the groups for this study was done according to recommendations of supervisors and project partners according to criteria such as CSS-representation, value chain coverage and UPS implementation status at the time of fieldwork. Finally, nine groups, including six UPS groups and three CL groups were chosen to be included and fieldwork was conducted. Due to the viability of the action research and quality and quantity of data collected, the results from only six of the nine groups, (4 UPS groups and 2 CL groups) are included in this report.

The group formation process of UPS-groups took place from September 21st 2014 to October 4th 2014 (MVIWATA, 2016). The process was facilitated by the National Network of Farmers' Groups in Tanzania (MVIWATA) in collaboration with scientists from Sokoine University of Agriculture (SUA) and researchers from the Agricultural Research Institutes (ARI) of Ilonga and Hombolo. In order to present the objectives of the UPS and to facilitate farmers' organization into the suggested groups, two-day village workshops were conducted in each of the four villages. Representative members of the 150 HH per village that participated in the previously conducted baseline survey were invited to participate in the workshops. At the beginning of each village workshop, the background and purpose of Trans-SEC was presented (MVIWATA, 2016). Afterwards, the suggested UPSs, their objectives and intended results for each village were presented and described. The process of UPS group formation and the criteria required to participate in the different UPS groups were explained and discussed. Finally, the farmers could decide to be part of a group to implement their intended UPS (max. two), provided that the farmer/household fulfils those predefined group specific criteria. In each UPS-group, a leadership committee made of Chairperson, Treasurer and Cashier was established to facilitate internal communication and coordination of group activities and to establish linkages between members and other partners in the project (Kaburire, 2015).

In the frame of Trans-SEC, the UPS groups are considered as research groups which are expected to implement the selected UPS through active participation and labour (and where appropriate, resource contribution) of group members. The group members are to share the skills and/or technology with other farmers in their sub-village, village, and even outside the village to contribute in dissemination of the UPS (MVIWATA, 2016).

The formation of the three CL-Groups was not facilitated by Trans-SEC, but the innovation implementation process was supported by the project³. All three groups undertook Participatory Scenario Building, facilitated by DITSL, to identify group-specific innovations, to explore potential risks and outcomes, and to select a suitable innovation for implementation. The groups then developed an action plan (in tandem producing a small video proposal to serve as a grant application). All three groups received a 500 Euro Action Fund grant to implement their selected innovation and defined action plan.

2.2 Selection of farmer participants and interviewees from the innovation groups

The participants of the group sessions and interviews were selected according to their willingness and availability, gender and age. Regarding the demographic factors, it was aimed to form a preferably heterogeneous study group consisting of six to ten participants from each participating innovation group. Whenever possible, a socially representative selection of participants, (i.e. including the oldest, youngest and middle-aged group members of each gender), was invited in order to account for the perspectives of different key social groups. Gender and age were already highlighted in previous research as important social factors affecting innovation uptake decisions (Schulz, 2016). The interview partners were chosen after the group sessions, not only to further understanding of the traits listed above, but also with regard to individuals representing a certain function or position in the group. This was done to include dissimilar (individual) perspectives, in order to clarify open questions concerning the group or the innovation process and to determine controversial views.

2.3 Qualitative research approach

This qualitative research aims to gain insights into the social reality of the individuals of each farmer innovation group. Multiple qualitative research tools, observations and interactions, as stated and explained in this section, were combined to learn about the farmers' view on expectations, priorities and satisfaction regarding their perceived individual innovation outcomes. To avoid predetermination of the frame and quality of possible innovation outcomes, no pre-defined indicators were stressed in this research. The purpose of the tools was then to support the farmers to express their individual perspectives on their experienced innovation outcomes. As such, a participatory approach was used in which farmers were able to identify, reflect, state and discuss their views through the application of the following tools within group sessions.

2.4 Field work data

The fieldwork data was collected from 1. February to 11th March 2016 through participatory study group sessions, supported by semi-structured interviews. The structure and content of each of the (four different types of) session are listed in **Annex 2-5**. The four participatory tools, as presented and explained, were applied during those study group sessions. The semi-structured interviews (see interview guide **Annex 6**) with selected participants were facilitated in the days following each session. All conducted participatory sessions and interviews were facilitated by the author in English and directly translated by a native Tanzanian Kiswahili speaker with excellent English skills and agricultural background. The summary of the conducted activities is illustrated in Table 2.

³ See (Fernandez, 2016; Schulz, 2016; Thapa, 2016)

Table 2: Summary of all conducted field activities

UPS or CL group	Village	Session	Most Significant Change	Outcome ranking	Opinion line	Missing link	SSI (n=)
UPS: Improved Maize Processing	Changarawe	A+B	X	4	-	X	3
CL: Bike rental business (Upendo)	Changarawe	C	X (P)	1	-	X	3
UPS: Poultry-crop integration	Changarawe	A	-	-	X	-	1
UPS: Improved market oriented storage	Changarawe	-	-	-	-	-	3
UPS: Rainwater harvesting & Fertilizer micro-dosing	Ilakala	AB	-	1	X	X	3
CL: Irrigation pump (Tuamiho)	Ilakala	C	X (P)	2	X	X	2
UPS: Improved Cooking Stoves	Ilolo	C	X (P)	1	X	X	3
UPS: HH nutrition education & Kitchen garden training	Ilolo	AB	X	1	X	X	3
CL: Soap making and Papaya farming (Wendo)	Idifu	-	X(P)	-	-	-	-

Source: Author; Green = conducted, white= missing, grey= excluded groups, 4 variations of group sessions: A, B, C, AB (**Annex 2-5**), Outcome ranking: nb of rounds conducted; X(P)= done by Pramila Thapa (Master Student) in 2015; n= number of conducted interviews, **Bold Text**: Short names of Groups that will be used in the text

2.5 Supporting observations, interactions and tools

This section provides an overview of the general tools applied and activities conducted to support the mutual understanding between farmers and researcher throughout the field work. This section is placed beforehand, to explain interactions and tools which were integrated into the specific POE tools outlined in 2.2.32.6.

Supporting Visual Tools

Visual tools found their application within group sessions and in interviews whenever using those mediums appeared feasible and meaningful. For example, innovation outcome themes, indicated/named by the farmers, were depicted on big round coloured cards, as shown in Figure 1. The collaborative determination, collection and confirmation of relevant innovation outcome themes for each group took place within the respective group session. The outcome themes were either symbolized by drawn signs or words written in Kiswahili. The usage of appropriate signs (symbols and icons) is considered to be more inclusive for illiterate participants (Percy, 1999) and was therefore preferred over the written Kiswahili term on the card. To ensure that an unambiguous, meaningful sign for each outcome theme was chosen, the Tanzanian translator with an agricultural background helped select the appropriate symbols. Because of his previous work with farmers and his drawing skills he was very helpful to elaborate suitable symbols. The signs symbolizing an outcome theme were drawn and written by him and the author, to deal with time constraints. The meaning was explained to the participants afterwards, and discussed and clarified again if necessary. Pictures of the cards used to symbolize innovation outcome themes of each group can be seen in

Figure 1: Cards on which group specific outcome themes were depicted



Source: Author; session (22.3C-7) with stove group, Ilolo

Annex 8.

In interviews, outcome cards were sometimes used to explain the session content to group members who were not participating in group sessions. Another visual tool (only used during certain interviews) to simplify conversation was a “drawn scale”. The purpose of this scale was to help group members think about, state and explain the extent to which different social groups benefit from the innovation applied and why. On the left side different gender and social groups were listed like Female, Male, Educated, Healthy, etc. In the top row were 4 degrees: from ‘four smileys’ on the left side, that stand for “certain group is perfectly benefiting from the innovation”, to ‘zero smiley’ at the right side, which is equal to the meaning that a “certain group is not benefiting at all from the innovation”. The interviewees were not asked chronologically for responses to all the groups. Instead they were free to express whether there were groups that benefit more or less than others. They could point with their finger on the scale to select a certain degree and were asked to explain their view.

Informal interactions and observations

During the period of field research, opportunities were taken to learn about people's living conditions and environment, in order to understand the context in which the IGs are situated. Therefore, several informal interactions took place, such as visiting farmers at their homes or at the field, demonstrations of applied machines and techniques, working with farmers in the field, or collecting explanations and examples from farmers on the extent to which they implement their innovations in their lives. The author was also wandering around, paying attention, listening, watching and participating in village life and activities, hosted and being thought by local families. During all those informal interactions, as well as group sessions and the semi-structured interviews, special attention was paid to details that might reveal information about the individual farmers' expectations, perceptions and satisfaction regarding their innovations. Hence, attention was paid to facial expressions, gestures, body language, mood of people and their actions, as well as the overall atmosphere of actions in which those meetings took place, in order to grasp the deeper meaning and context of spoken words and actions⁴. This informal observation of people and their activities was not analysed as such, but was aimed to gain knowledge and improve understanding of farmers' views on environmental conditions, innovation systems, group interactions, processes of implementation and innovation outcomes. Therefore, the observations formed an important part of the research process and influenced the questions that were asked.

Allegory used to specify content

At the beginning of the participatory sessions and semi-structured interviews, the farmers were asked about the changes they expected that the implementation of a certain innovation might bring them before the innovation process started. An allegory of an expectant mother was used to explain that the farmers should consider themselves as the parents and the innovation as their unborn baby. This comparison was useful to differentiate between recently made experiences, thoughts and hopes they had, before they actually started to implement the innovation. The image of a pregnant woman is familiar to the farmers. For that reason, the farmers could easily understand the allegory, which helped to clarify that the question aimed to recall their previous point of view without the consideration of already experienced outcomes. Beside this example allegory, others were used⁵ to translate the researcher's purpose in an unambiguous way to the farmers.

2.6 Participatory outcome evaluation with innovation farmer groups: techniques and activities

The different tools of qualitative, participatory outcome evaluation as stated and explained below were applied in sessions (see **Annex 2-5**) conducted with members of six innovation groups along the four CSS. Two Sessions per group (A and B) were originally planned to take place in order to facilitate the participatory tools. However, in the first sessions it turned out that the farmers appreciated it more to combine those tools. Therefore, the content of the former two sessions was adapted and combined during the field stay to one group session (AB) per group. Due to the fact that one tool (Most Significant Change) was already applied with 3 groups by Pramila Thapa⁶, another group session variation (C) came into use. The principle aim of the group sessions was to gain a comprehensive insight into innovation group members/farmers' expectations, priorities, perceptions, and satisfactions regarding their different self-identified innovation outcomes to reveal how the individuals experience (their) outcomes differently.

⁴ For more details see: (Mack et al., 2005; Metge and Kinloch, 1988)

⁵ Example: **Farmer**: All these (innovation outcomes) are important, right? **All**: Yes. **Translator**: But you just choose one that is most important for you. Let me give an example: Soft drinks. Children love to take different kinds of soft drinks like Pepsi, Fanta but there is no person who can take all the soft drinks. (I am explaining because some have not understood.) You can drink all the soft drinks but you have one that is the most favorite. All the outcomes are important for you, but there is one that is most favorite and you can explain why. **Farmer**: ok I have understood

⁶ Pramila Thapa conducted her Masters thesis field research in the frame of Trans-SEC in October 2015.

All group sessions started with a brainstorming exercise where farmers were specifically invited to reflect on their expectations before they started to implement their innovation from their previous point of view. Farmers came up with their recent expectations of the innovation process by themselves (at any point) during sessions and interviews.

All techniques and tools were adapted among the groups according to the feasibility of their use and suitability in terms of session content, time constraints, number of participants and level of group motivation. Even though sequence and content differed among the group sessions, they were based on the content and timeline of the framework displayed in Table 3.

Table 3: Example framework of conducted group session

Task	Realization	Tool
<ul style="list-style-type: none"> - Introduction of me and my objectives - Consent (Audio, time duration, photos) - Short presentation of the participants - Presentation of the meeting purpose, content and schedule 	All participants sit in a circle	
<p>Ask participants to remember the time when they have met as a group for the first time: What changes have they expected, the innovation will bring them?</p> <p><i>Get to know previous expectations and reasons for participation</i></p>		Brainstorming
<ul style="list-style-type: none"> a) Participants shall do paired interviews to explain each other their “stories of change” on the HH level b) Stories are shared among the group; development of stories by “owners” or through questions c) Collaborative selection of the MSC story <p><i>Different outcomes and individual reasons, why outcomes are considered as important</i></p>	depict farmers’ outcome themes on cards	MSC workshop, Group discussion
<p>Show farmers’ identified outcome themes to confirm and discuss findings within the group (something to add?)</p> <p>For each outcome: Ask to whom this outcome is relevant</p> <p><i>Concerned people stand up build opinion line for each outcome whether the actual outcome has met the expectations or not. – ask for explanation; (gender, age?)-> take a picture; Individual statements</i></p>	Depicted outcomes; draw line (include cross explanations)	Opinion line
<p>(Ranking and) discussion about which outcome is important for whom and why (-> every Participant get 2 Stickers in different colours in order to decide which outcome is important for different social groups (e.g. women, men,))</p> <p><i>Information on which key socio-cultural factors have considerable impact; (why and how) socio-cultural factors are influencing</i></p>	Ranking done with Stickers on depicted outcome theme cards	Outcome ranking
<p>Coming to the end</p> <p>How do you feel about the innovation and the already achieved outcomes (Has one something to add?)</p>		Feedback round

2.6.1 Most significant change technique

The Most Significant Change technique is a tool for Participatory Monitoring and Evaluation (PM&E), which was invented in 1994 by Rick Davis to be applied in a participatory rural development project (Davies, 1998). This qualitative approach can be used and adapted for several purposes (Dart and Davies, 2003). It is recommended to combine this methodology with other tools and approaches in order to get the most profound results (Dart and Davies, 2003). This dialogical, story based technique does not provide any quantitative indicator, thus revealing the participants’ values more openly. It

consists of the collection and systematic participatory interpretation of participants' stories of change.

For this study, the MSC technique was used to identify outcomes in an open, non-directed way and to provide space for discussion of the relative valuation of these outcomes for different farmers. Participating farmers were requested to think about changes they experienced on the household level since the implementation of their innovation. In pairs, farmers narrated their prioritized story of change within 5 minutes to each other. The prearrangement in such small groups mitigates concerns of expressing the farmer's own view to the group. Afterwards, the whole group came together and the farmers recounted the story of their partner to the whole group pair by pair. The participants were invited to add or correct something to their own story if wanted. After all the stories were told, the group discussed which of the stories of change is most significant to the whole group. Through the content of the stories and the group discussion about the importance of different changes, valuable insights of the farmers' relevance system and their own perspectives were gained, which are considered more meaningful than the story selection itself. In two groups, the Most Significant Change technique was applied by the author in February 2016; in three groups such exercises were already conducted by Pramila Thapa in October 2015. In the three groups, the transcripts of the sessions were analysed prior to the sessions to predefine possible outcome themes of the groups in advance, in order to verify them within the session.

2.6.2 Opinion line

The opinion line is a well-known tool often applied in German environmental education (Blessin and Remesch, 2014). In scientific literature, it was neither found the applied variation of the opinion line, nor was it described to be used in the context of SHF groups (in development projects). However, it appeared to be a suitable tool in this research environment, to gain insight in farmers' satisfaction regarding their experienced innovation outcomes and to reflect in how far individual expectations have been met.

Figure 2: Farmers positioned themselves along the “Opinion line” to express their satisfaction regarding their already gained knowledge about Improved Cooking Stove since implementation of the innovation



Source: Author; session (22.3C-7) with stove group, Iloilo

Figure 3: Translator explains outcome ranking to farmer group



Source: Author; session (3.1B-3) with processing group, Changarawe

Figure 4: Depicted outcome themes voted by farmers with red stickers according to their individual priority



Source: Author; session (23.2AB-8) with KG group, Iloilo

To form an opinion line, the participants stand up to position themselves on an imaginary line as shown in Figure 2. One end of the line represented the view “expectations not met at all” and the other end represented “expectations fully met”. For each depicted (collaboratively determined) innovation outcome theme, an opinion line was built by the participants. Next, the participants

positioned themselves on the line according to their satisfaction regarding a specific outcome. Cross-explanations were applied whenever possible, whereby participants with different opinions were asked to state possible reasons as to why others may experience the outcome differently to themselves. After farmers were elaborating those views about the hypothetical reasons for a certain degree of satisfaction of other members, those other members were asked to explain their own individual reasons. Discussions among the participants gave valuable insights about the innovation and to learn how different outcomes are embedded in the participants' community.

2.6.3 Outcome ranking

Chambers (1992) stated that ranking provide people with occasion and mean to reflect on problems and opportunities as they perceive them and to express their preferences. The variation of outcome ranking, as it is applied in this research, could not be found in the literature, but Chambers (1992) also recommended a flexible use of methods and tools suitable to local conditions and adapted according to fields of investigation. Ranking is a rather simple and straight forward tool to reveal the participants' prioritized innovation outcomes, to learn which one is most important for each individual. It is a suitable way to get to know which outcome is important to whom and why, and to show which outcome themes are most appreciated within an innovation group. Even though this tool refers to individuals' prioritized outcomes, it is named ranking, as it is reflected on the overall importance of different innovation outcomes to the group.

The (collaboratively determined) innovation outcome themes, depicted on cards, were placed visible to all participants in the middle of the sitting circle, as shown in 3. The participants received a small sticker and were asked to stick it on their individual prioritized outcome theme card (see Figure 4), denoting their most appreciated outcomes. The participants placed their sticker on the outcome cards one after another. When they placed a sticker they briefly stated why they chose a certain outcome theme and explained the relevance of their specific, appreciated outcome. This version of outcome ranking, showing the individual's most valued innovation outcome and the priority of certain innovation outcome themes within the group, was conducted with four groups. According to time availability, the content of the sessions, the number of participants and the group motivation, two longer adaptations of this exercise were conducted with the remaining two groups, as explained below.

With one group, four rounds of outcome ranking, sensitive to different socio-cultural factors, were conducted. This could be done with a small group of six participants of the processing group in the second group session (B) (see Figure 3). All participants were asked to think about themselves in different rounds as man, woman, better off, or without any formal education and to indicate with different stickers which outcome might be the most appreciated in a certain social context and why. With another group, the rating was done with special sensitivity to gender issues. Two rounds were conducted in which the participants chose which outcome they thought is most important, either for men or for women. In these two adaptations the answers were given either according to personal background or hypothetically, when the individual participant did not feel belonging to the social groups they should consider. Switching roles was encouraged to identify and state the value of certain outcomes for people in different social contexts, from an empathetic perspective.

2.6.4 Feedback sessions

These kind of sessions (see outline **Annex 7**) took place at the end of the field work period to present, verify and discuss the preliminary findings obtained by the researcher. The principle aim is to learn from each other through expression, sharing, and contextualisation of those findings for a common understanding between participants and researchers (Kaufmann and Hülsebusch, 2008). Feedback sessions are a practical way to reinforce lessons learned from participative activities, as they are a possibility to contextualise research findings. Additionally, it is a suitable way to meet

farmers' interest to make use of their own investigations, as results of scientific research rarely find their way back into groups or communities. For that reason, one feedback session of approximately 3 hours took place in each CSS.

Due to the authors experiences made during the field work, and the preliminary content analysis of the conducted sessions and interviews within the field stay, it seemed that most farmers did not benefit from the innovations as much as they potentially could. To address this issue, the tool called "Missing link" was applied during the feedback sessions. This participatory tool was applied to support the farmers to reflect their action possibilities in order to detect their individual options to influence and shape their innovation process, if feasible. The farmers were asked to think about what is needed, such that they personally would be fully satisfied with their innovation outcomes. Subsequently, the groups elaborated restricting factors, or "missing links" that impede farmers to capitalize upon the potential benefits they could experience for their different outcome themes (see Figure 5). After this group work was presented, the farmers were asked to reflect on their own room of manoeuvre, to think about their personal opportunity to change something or choose between different ways of doing something in order to improve their own situation (see Figure 6). This tool was also applied to make the researcher understand the participants' perception of their individual action possibilities and to learn about factors restricting their room of manoeuvre.

Figure 5: Water pump group elaborated "Missing links" to each outcome theme



Source: Author; feedback session (31.FB-3), Ilakala

Figure 6: Water pump group elaborated action possibilities to overcome their "Missing link"



Source: Author; feedback session (31.FB-3), Ilakala

2.7 Semi-Structured Interviews (SSI)

The semi-structured interview was chosen to explore, capture and understand the interviewees' narrations of activities, experiences, views, and opinions within the scope of research objectives, by constructing knowledge from the interaction between interviewee and interviewer (Kvale, 2008). Based on the leading research questions, the semi structured interview guide was developed prior to the field work phase (**Annex 6**), to structure the interviews, which were individually adapted according to the interviewees. One major research objective is the investigation of individual participants' expectations, prioritization, and perceptions regarding their innovation outcomes and systematisation of the experienced innovation outcomes. For a comparative analysis of statements, the interview guide was used to navigate through the interview and to assure that all relevant parameters to achieve the research objectives were considered. Then, an open interview flow was used to provide space for the interview partners to also come up with relevant aspects that were not previously thought of by the researcher, and to reduce possible bias of the results. Therefore, an exploratory and open-structured interview approach was chosen (Kvale, 2008). Care was taken, that

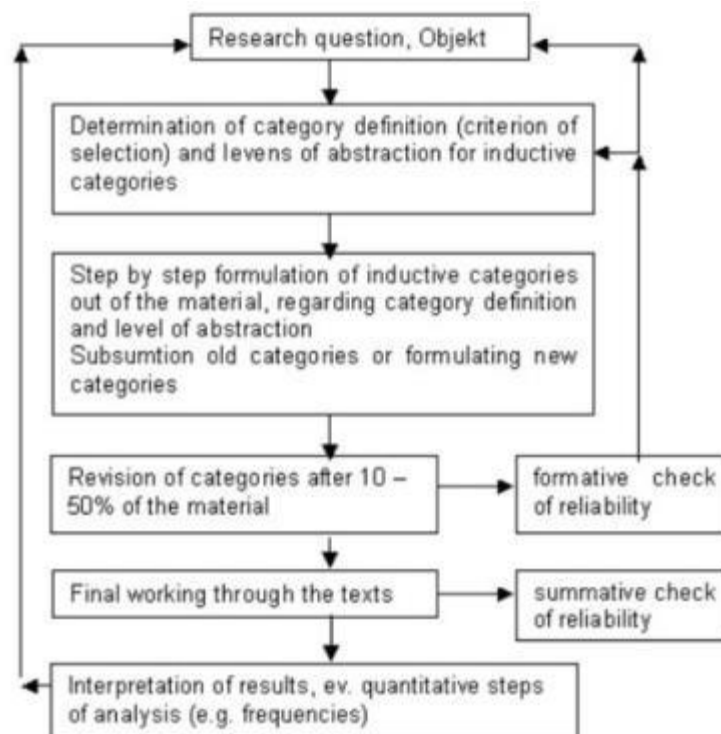
the duration of each SSI did not exceed one hour, of which 17 SSI were considered and analysed for this research.

2.8 Data analysis and presentation of collected field work data

The focus of the analysis is of an explanatory nature, rather than aiming for quantification. Even though some tools would render a quantitative analysis possible, the exploratory and “open” character of this qualitative participatory research aims more to highlight farmers’ explanations of their views regarding their innovation outcomes, in their specific context.

All interviews and group sessions (constituting 31 hours) were audio recorded and transcribed - the English parts (of the author and the translator) word for word, and the Swahili parts translated as closely as possible and transcribed by three typists who were native Swahili speakers from Tanzania and Kenia. As the analysis of the transcripts was focused on the literal content, non-verbal attributes were not considered. The written version together with the recorded one, plus the field notes constitute the material for the ensuing content analysis. The combination of all available data allows a reasonable interpretation of the meaning of the spoken words. The transcripts were introduced into a qualitative data analysis programme (R; version: 3.2.2 (2015); packet “RQDA”; version: 0.2-7 (2014)) for qualitative content analysis. This method is suitable for theory based, flexible but structured systematic analysis of transcribed communication. It includes the stepwise development of concepts and categories that are applied to the text in order to aggregate meaning contained in different categories to organize them in a System (Mayring, 2000). In this research, categories with attached codes were developed inductively, as depicted in Figure7.

Figure7: Step model of inductive category development



Source: (Mayring, 2000, p. 4)

An overview of the categories and codes as finally applied and used for the content analysis of the transcribed group sessions and interviews is provided in the coding frame shown in Table 4.

Table 4: Overview of categories and codes of the coding frame

Category	Group Frame	Expectations	Outcomes	Priority	Satisfaction	Restrictions	Socio-cultural
Codes	Group Frame	Exp. before	Money	Importance	Outcome	Individual	Gender
		Exp. after	Time	Reason	Ext. factors	Ext. factors	Age
			Knowledge		Innovation	Innovation	Education
			Inter-connect		Group	Group	Other

Source: Author

The data retrieved by the codes of the categories “Outcomes” were further distinguished as stated in the Tables in section 3.

3. RESULTS

3.1 Innovation group profiles and current state of innovation implementation

Two groups from each village CSS participated in this research. The large variability between the IG's regarding their type, number of members, innovation and the level of implementation at the time of fieldwork is displayed in the Table 5 below.

Table 5: Overview of the six participating innovation groups

UPS or CL group	Village	Group Type	Date of group formation	Start of implementation	innovation area	n	implementation
Improved Maize Processing	Changarawe	UPS	Sep 2014	Aug 2015	Processing, mechanisation	16 (-11)	G
Bike rental business (Upendo)	Changarawe	CL	Nov 2013	May 2015	business, income generating	20	G
Rainwater harvesting & Fertiliser micro-dosing (MD)	Ilakala	UPS	Sep 2014	Jan 2015	Natural resources, crop production	40 (-11)	HH
Irrigation pump (Tuamiho)	Ilakala	CL	June 2013	May 2015	Natural resources, crop production, mechanisation	12 (-5)	G
Improved Cooking Stoves	Ilolo	UPS	Sep 2014	Feb 2015	Processing, natural resources	25 (+38)	HH
HH nutrition education & kitchen garden (KG) training	Ilolo	UPS	Sep 2014	Aug 2015	Vegetable Consumption	27 (+24)	HH

Source: Trans-SEC reports unpublished: (DiTSL, 2015; Kalagho, 2015; Lyamuya, 2015; MVIWATA, 2016); **text:** short names of the groups as referred to in the text; UPS: Upscaling Strategy, CL: Collaborative learning, G: Group, HH: Household; n: number of group members; (n); Number of (+) adopters, (-) dropped out

The UPS- groups were new founded groups (in Sept. 2014) of farmers who opted to implement a certain innovation (selected and presented in the frame of Trans-SEC). It was stated, that at the beginning of the implementation process the majority of the farmers had a poor understanding of the project and its expected results (MVIWATA, 2016). In contrast the CL-groups were pre-existing groups, of which the members decided collaboratively to implement a certain innovation. The innovations of three of the four UPS-groups are implemented at household level, wherefore those are to some extent less dependent on group activities⁷. Only one UPS-group (processing-group) and the two CL-groups implement their innovation at group level, wherefore the group reliability is of great importance in those groups. More details about all six group and their implemented innovations is given below.

Improved Maize Processing group

This UPS group from Changarawe village consists of 16 members, of which there are 12 men and 4 women. In the CSS, primary processing of harvested maize is still mostly performed manually by women and children in a labour-intensive way, as part of domestic labour (Yustas et al., 2016). The group's name "Improved maize processing" refers to the group's way of mechanized processing

⁷ as long as the group members know how to implement (build, use, apply, repair, adapt) their innovation by themselves;

through the acquisition of a maize shelling machine. The initial group criteria, to be able to contribute to the costs to purchase the machine, lead to a high drop out rate, before the implementation process had started. Due to farmers poor financial status, there were not enough farmers who were capable those pre-defined criteria (MVIWATA, 2016). Therefore, farmers got 5,200,000 TZS (2150 €) loan from the National Network of Farmer' Groups in Tanzania (MWIVATA) to purchase the machine⁸. As the machine was provided to the farmers it had some technical problems that required to be worked out first before the processing could start (Kaburire, 2015). The first harvest season in which the maize shelling was done mechanically started in August 2015. The farmers stated that a maximum of 20 sacks of maize of approximately hundred kg each can be processed within an hour⁹. The customers are charged 3000 TZS (1.25 €) per 100kg of maize. In one day, it is possible to carry the machine to the field of 3-4 farmers (if they are nearby), but the amount of maize that has to be processed is strongly dependent on the farmers' yield and therefore varied from 300kg to 1200kg per day. The processing group formed two operating teams of eight people each. Therefore, each member of the processing team of minimum seven people (to be able to push the machine) earned between 1000 TZS (0,4 €) on a poor day and 5000 TZS (2 €) on a really good day. Even though the farmers mentioned that due to drought it was a poor maize season, the group members were able to pay back 600 000 TZS (248 €) of the loan by the earnings of the first season.

Moving the maize sheller is a main challenge for the group, because seven people are needed to push the machine by hand to the field, because of the lack of a suitable towing vehicle, like a tractor, in the village. When the machine was inspected it turned out that it was not well serviced (with grease) and not as regularly started as recommended which impaired the manual starting process. Within the group only two people are able/responsible to manually start and service the machine and it seems that no handbook or user manual on how to operate and maintain the machine is available. The group success will be conditioned by climatic conditions and the amount of harvest which can be processed, as well as the knowledge on reparation and maintenance of the machine will be critical.

Bike rental business group (Upendo)

This CL-group from Changarawe village consists of 20 members, half of which are men and half women. The group was established in November 2013 out of a pre-existing group in the frame of a CCM (ruling political party in Tanzania) youth organization. Upendo started as a farmer group cultivating vegetables and later implemented a bike rental business to gain capital to increase the group farm activity in May 2015. Differing expectations regarding economic organization and business operation, as well as political differences during the election period in October 2015, were cause of conflict between group members and a source of mutual disappointment among members (especially between two so called "trouble-makers" and the group leaders). The farmers stated that, due to unusual heavy rain in December and February 2016 the cultivated group farm was flooded and destroyed. In order to protect the group bikes from damage in such a muddy environment, they were stored away since December. The group meetings (usually conducted on a regular weekly basis) did not take place for three months since that time. Some members stated the intention to sell the ten old bikes and purchase new ones in better condition. A meeting of the whole group is crucial in order to overcome those challenges and to decide about the group's new strategy.

Rainwater harvesting & Fertiliser micro-dosing group

This UPS group from Ilakala village consists of 40 members, of which 28 are men and 12 are women. The members of the micro-dosing group received training to prepare their field for *in situ* rain water harvesting and the application of small amounts of fertilizer attached to every seed. This practice

⁸ MVIWATA delegates and a group representative were involved on machines procurement process(Yustas et al., 2016)

⁹ According to the projects fact sheet about the group, the maize sheller has a capacity of shelling up to 70 bags/hour. In 2015 57600 kg maize grains were obtained through mechanical processing by the group, for which 126,000 TZS (approx. 52 €) fuel cost had to be paid to run the machine (Yustas et al., 2016)

aims to counteract declining soil fertility in the CSS, (due to continuous farming without replenishment of nutrients,) as well as to improve soil water management in the fields to augment crop yields (Germer et al., 2016). To make the effect of four different cultivation practices of maize comprehensible, farmers take a $\frac{1}{4}$ acre piece of their own land, the so called “baby plot”, with four parcels of approximately 253 sqm (1/16 acre) as follows:

Tie-ridges, + fertilizer	Flat land, no fertilizer
Tie-ridges, no fertilizer	Flat land + fertilizer

Source: Author

During the field stay it was the second season in which the farmers implemented this way of cultivation, which the farmers refer to as “modern” farming. The fields were cultivated with maize intercropped with sesame in the first season in 2015 and maize intercropped with leguminous pigeon pea (*Cajanus cajan*) in the second ongoing season. The late

sowing dates of the baby plots were dictated to the farmers, which caused a big time gap between other fields and the trials which made a direct comparison between the farmers’ regularly farmed fields impossible. The farmers stated that low and/or erratic rainfall is a restrictive factor, because drought in the last season and heavy rains (floods) in this season strongly affected yields, up to total losses. It may be that high costs of fertilizer deter small-scale farmers from using recommended rates to improve soil when the fertilizer is not sponsored by the project anymore, because accessibility and availability of farming inputs seems to be a major challenge according to members. Therefore, low income and timely access to inputs is critical together with climatic conditions.

Irrigation pump group (Tuamiho)

The CL-group Tuamiho from Ilakala village consists of 12 members, of which five are women and seven are men. The group formation was in June 2013 after a sensitization meeting conducted by MJUMITA in collaboration with the extension officer, in which villagers were assembled and asked to form a group aiming at the implementation of horticultural activities. Since its formation, the group has been involved in the production of manually irrigated tomatoes on a rented land. To realize the group’s innovation strategy, Tuamiho acquired an irrigation pump in May 2015 and received training on the use of the machinery, on group management, and horticultural practice. The irrigation pump has reduced the work load for irrigation, but the transportation of the pump to the field remains a big challenge. According to the farmers 90% of tomato harvest in the last season was not marketable due to invasion of Tomato leaf-miner (*Tuta absoluta*) as new pest to east Africa (Izlar, 2015). In this season, the cultivated field and nursery were flooded and destroyed during January and February 2016, therefore the farmers are waiting for the next season to replant their fields. The group farm is near a river, for ease of irrigation, but as such it was easily flooded. Therefore, the group is searching for a new piece of land on a higher altitude with access to irrigation water.

Improved Cooking Stove group

This UPS group from Ilolo village consists of 25 members of which are 13 men and 12 are women. The group members received training on how to build a so-called Improved Cooking Stove (ICS), made of clay, iron and bricks which are available in rural areas. The purpose of the ICS implementation is to achieve higher cooking efficiency, to gain fuelwood and time savings, and less health effects via smoke reduction (especially for woman) (Uckert and Graef, 2016). The aim of the group is to build stoves for their own, private use and to work as constructors for customers nearby. The price for an ICS built by the group currently is 2000 TZS (0,80€) of which 200 TZS (0,08€) belongs to the constructor and 1800 TZS to the group. One especially ambitious member possessed the know-how and built more than $\frac{3}{4}$ of the stoves ordered by customers, without extra compensation for his commitment. Recently, there are 38 adopters within the village, who had received an ICS from the group. At the beginning of 2016, a decline of new adopters was noticed, due to high workload within the agricultural season. The group members, which are mainly farmers themselves, also stated the farming responsibilities as the reason for neglected group activities, such as meetings, PM&E of the ICS, and acquisition of new customers, in 2016. The group wished for capital or new project activities

that could generate more revenue, as the rate of 2000 TZS per stove was considered to little. A credit and saving scheme is desired, but not implemented, due to lack of financial means.

HH nutrition education & kitchen garden training group

This UPS group from Ilolo consists of 27 initial group members of which 17 are women and 10 are man. The group members participated in trainings about household nutrition and workshops on kitchen garden (KG) preparation. Especially in semi-arid areas where water is scarce, the introduction of bag¹⁰ and tray¹¹ gardens, (the so called “kitchen gardens”), is recommended for more water efficient vegetable cultivation compared to conventional ground gardens (Lambert et al., 2016). Kitchen gardens are usually on the doorstep for ease of irrigation and to ensure immediate availability of vegetables. The increased availability of leafy vegetables as well as the training on HH nutrition aims to increase awareness on the importance of micronutrient intake in order to improve HH food consumption patterns (Lambert et al., 2016). All required materials for establishment of KGs are available in this rural area. The group’s secretary additionally received training to teach members on topics including breastfeeding, cooking, food ingredients and nutrient supply. Due to the groups secretary’s efforts to spread the KG idea and to help adopters build their own, there are around 24 new adopters who possess at least one kitchen garden in their HH. Those adopters are not considered as group members as they did not take part in the trainings, workshops or group meetings. A few members who possess more than one bag were able to sell vegetable bundles to neighbours or villagers. Only the group’s chairperson (with an entrepreneurial spirit and dominant character) has five bags. The bags in use degrade after six months, wherefore they have to be replaced on a regular basis. There were concerns regarding future access to seedlings and pesticides by the farmers. Overall, water scarcity, water payment, fences to protect the bags from animals, pest management, and successful seed propagation are critical for the group’s success.

3.2 Overview of the intended innovation outcomes

It is important to remark, that the intended outcomes of the UPS groups were elaborated by Trans-SEC researchers and subsequently communicated to the farmers during the UPS group formation process. The already existing CL-groups, on the other hand, envisioned outcomes from their own perspectives, facilitated by DITSL. The CL-groups’ intended outcomes will be reflected in farmers’ expected innovation outcomes (see Table in section 3.3.1) as the realization of those expectations is the motivation to implement their self-selected innovation. Therefore, only the intended outcomes of the UPS groups that were pre-defined by scientists of Trans-SEC are presented in the following Table:

Table6: Overview of intended innovation outcomes of UPS groups

UPS group	Intended outcomes
Improved Maize Processing	<ul style="list-style-type: none"> - to increase the efficiency of shelling maize to reduce human labour - to improve the livelihood of farmers (especially group members) - to generate knowledge and awareness about better and more efficient processing methods
Rainwater harvesting & Fertiliser	<ul style="list-style-type: none"> - to introduce sustainable soil fertility management (reduction of soil erosion to conserve soil moisture in the field) - to increase crop production (yield) and crop productivity

¹⁰ To build pocket/bag an empty rice bag is filled with manure, sand, soil and pebbles supported by a stake in the middle

¹¹ To build a tray garden plastic material is inserted into a square hole then filled with pebbles, dry grass and the mixture of soil, sand, and manure on which crops are planted on top; those were observed less frequently than bag gardens.

micro-dosing	<ul style="list-style-type: none"> - to improve groups food security status by increasing their corn yields (lower staple food prices)
Improved cooking stoves	<ul style="list-style-type: none"> - to reduce poverty of users and producers - to generate income for stove builders and group - to improve the economy of the rural people - to reduce the pressure on fuelwood demand (high reliance on wood fuel (fuel wood & charcoal) as the main source of energy) through higher cooking efficiency - to ensure environmental sustainability (mitigate forest degradation and deforestation due to less wood fuel demand) - to save time for food preparation and firewood collection (especially for women) - to build knowledge on stove building (improve the improved stove) and firewood preparation (storage and drying) - to establish the training of trainer concept to share, disseminate and sustain the knowledge among village households. - to provide stove construction service to other households. - to improve health via smoke reduction
HH nutrition education & kitchen garden training	<ul style="list-style-type: none"> - to improve food consumption patterns - to improve dietary diversity and nutrient intake of all HH members - to overcome knowledge gap through provision of nutrition training to men and women - to use a group approach and group leaders for technical training to introduce kitchen gardens (KG) ("Tray" gardens and "bag" gardens) - to gain sustainable supply of vegetables all year round (KG Require little irrigation, suitable to arid environments) - to provide direct access to vegetables that can be harvested, prepared and fed to household members, (often) on a daily basis - to ensure vegetable quality through own cultivation - to diversify diet through introduction of new types of vegetables, like chinese cabbage, collard greens, spinach and amaranth - to lower production costs (low input), increased area of cultivation - to produce vegetable surplus to increase income through marketing of those.

Source: 1Trans-SEC: UPS-group factsheets

To provide an overview of the intended innovation outcomes, so-called outcome domains are used to categorize the intended outcomes as shown in Table. The outcome domains are based on dimensions of well-being, which include physical, financial, intellectual, environmental, social, emotional, spiritual and occupational wellness (WSU, 2013). These dimensions of well-being offer an integrated overview of human life and are chosen to indicate in which dimension of farmers' life the innovation outcomes might cause notable changes. When the intended outcomes are categorized according to dimension of farmers' lives, five of the eight aforementioned dimensions of well-being were addressed, which are the physical, financial, intellectual, environmental and the social. Therefore, it is appropriate to introduce five outcome domains to sort outcomes according to the dimensions of farmers' lives that are intended to be influenced by the innovation outcomes, which can be seen in Table7. To include the CL-groups into the comparison, group members expected outcomes are also transferred to outcome domains.

Table7: Overview of the intended innovation outcomes by outcome domains

IG	Physical	Financial	Intellectual	Environmental	Social
Processing	X	X	X		
Bikes		X	X		X
MD	X			X	
Pump	X	X	X		X
Stoves	X	X	X	X	
KG	X	X	X		
n groups	5	5	5	2	2

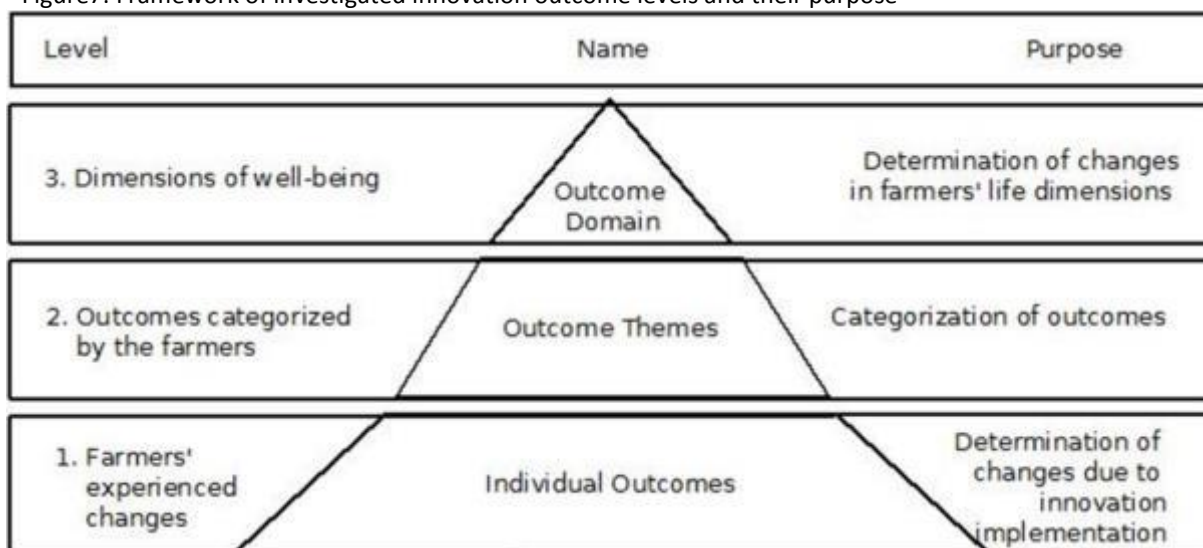
Source: UPS-groups: Trans-sec: UPS-group factsheets; CL-groups: farmers' expectations (see Table)

Table7 shows that all innovations have intended outcomes spanning across the spectrum of different domains. It is clearly indicated that outcomes which are assigned to the "Physical", "Financial", and "Intellectual" domain are the outcomes most commonly intended to result from innovation implementation. Outcomes which refer to farmers social well-being were intended only by the CL-groups, but not by the UPS-groups.

3.3 The farmers' view on their innovation outcomes

This section refers to farmers' perspectives on outcomes, whether positive or negative, that the implementation of a specific innovation brought them. To reflect the farmers' views and to capture the experiences of change in their lives, this research includes three different levels to investigate farmers' innovation outcomes, which are shown and explained in Figure7. In order to facilitate the communication of the various outcomes, farmers' individual "innovation outcomes" (level 1) were categorized by "outcome themes" (level 2) that the farmers came up with during the conducted group sessions. The "outcome domains" (level 3) were introduced after fieldwork to establish a relationship between the rather specific "outcome themes" and the overarching dimensions of farmers' lives. The "outcome domains" provide an overview to reflect on the influence of "innovation outcomes" on farmers' lives on a broader basis, in order to determine and compare the intended and actual influence of innovation outcomes on farmers' lives at large.

Figure7: Framework of investigated innovation outcome levels and their purpose



Source: Author

For the analysis, this categorization (as shown in Figure7) functions as a framework to summarize important aspects of how outcomes- as changes in farmers' lives -were perceived. When a certain outcome theme is referred to, it is important to consider that the theme itself indicates neither the incidence nor the quality of changes experienced by the farmers. Only the single outcomes within a certain theme give detailed description of the specific changes experienced by the farmers. For example, outcome theme "Time" refers to all changes in farmers' time management; only the explanation of a single outcome within this theme reveals whether the innovation implementation reduced or increased farmers' workload hence costed or yielded time .

The tools for participatory outcome evaluation, as described in section 2.6, were applied during the group sessions in order to learn about the farmers' individual expectations and perceptions, including satisfaction and priorities regarding their different innovation outcomes. In this way, it was possible to not just get to know the important innovation outcomes, but also to gain an insight into the extent to which farmers' expectations have (or have not) been met and to identify the degree of satisfaction (DOS) regarding certain outcomes. As a point of entrance, farmers' expectations, with regard to their different innovations are stated, before the three most frequently determined outcome themes are identified and investigated, as well as single outcomes of each theme are discussed in detail.

3.3.1 Farmers' expectations of innovation outcomes

Expectations are beliefs that are centred in the future and may perform a causal role in the production of behaviour (Schwitzgebel, 2015). Those individual expectations may later function as benchmarks to self-evaluate experienced innovation outcomes. The summary of the farmers' expectations in the Table8 is structured as follows: For each of the six groups, the expectations stated by farmers are divided into two sections which are "Expectations the farmers had in the time before innovation implementation started" in the left column and "Expectations farmers stated from their recent point of view during/within implementation, concerning the future of the ongoing innovation process" in the right column. The different colours used, indicate whether the expected outcomes are innovation-specific expectations (black), or more general process-related expectations (blue).¹²

¹² In case of innovation implementation on HH level (see Table) group activities are considered more process related, when the implementation is on group level, the group activity is considered to be innovation related.

Table 8: Summary of farmers' expected innovation outcomes in each group

UPS or CL group	Expectations before implementation	Expectations after implementation
Improved Maize Processing	<ul style="list-style-type: none"> - Simplify shelling process - Spend less time for shelling - Have a portable machine with means of transportation - Get rid of poverty - Raise living standard - Empower the group, or at least improve situation - (No expectations, no dreams, no wish, no hope) 	<ul style="list-style-type: none"> - have huge (financial) progress when means of transportation is provided - be a more experienced group that is able to deal with innovation related challenges - Convince donors to provide means of transportation
Bike rental business (Upendo)	<ul style="list-style-type: none"> - Realize a group project of marketing and business - Receive training for business - learn from other group members (bicycle business) - Have a group which is recognized by the government (loan) - Stimulate support and unity within the group - Learn about farming - Build a group of entrepreneurs who work together to overcome poverty - Establish credit and saving scheme within group 	<ul style="list-style-type: none"> - Expand bike business - will help to achieve group goals through restriction of customer debts - bring group progress when leaders are more united - have better organizational structure when financial report will be presented regularly to the group - Have fewer restrictions through weather conditions - Decrease distrust and fraud within the group - have a better functioning group - Transparent credit and saving scheme within group
Rainwater harvesting & Fertiliser micro-dosing	<ul style="list-style-type: none"> - Get knowledge to improve farming - Do more efficient farming and have higher yields - Get more income - Increase living standard 	<ul style="list-style-type: none"> - increase harvest through fertilizer application on bigger field size (more than ¼ acre) - Find a way of helpful and beneficial farming, to have more income and food (raise living standard) - receive more training to learn how to deal with innovation related challenges - Increase yields of forthcoming season due to better environmental conditions - Have agricultural shops that provide fertilizer and seeds - mitigate deforestation due to less farmland demand and afforestation
Irrigation pump (Tuamiho)	<ul style="list-style-type: none"> - Increase support and love within the group - Get loan by the government (to buy tractor) - improve individuals' lives and 	<ul style="list-style-type: none"> - receive more training to be more skilful in order to deal with general challenges - increased number of group members could help the group to improve its situation

Some expectations may be group related but not innovation related, for example: “learn about farming” in the bike group

	<ul style="list-style-type: none"> economic situation of group members - have development and success (build a bigger house) 	<ul style="list-style-type: none"> - find a new pesticide that is able to reduce tomato leaf-miner problem
Improved Cooking Stoves	<ul style="list-style-type: none"> - Reduce work load of fetching firewood - Have a source of income (stove construction) - Save money 	<ul style="list-style-type: none"> - learn more about stoves (new techniques) - to improve life of celibate men (simplify cooking) - Provide a stove to everyone in the village - Mitigate deforestation - improve the groups work, even just by a part of the group members
HH nutrition education & Kitchen garden training	<ul style="list-style-type: none"> - eat a more balanced diet, to have a better nutrient supply - Improve nutritional status and health, (especially of children) - Harvest additional food during dry season - Vegetable supply without extra costs, nearby - Reduce costs of living (food) - Have source of income 	<ul style="list-style-type: none"> - build more bags to increase income and food supply - ensure access to food in an emergency case - have additional food from kitchen garden, to sell vegetables from regular garden - own and irrigate many bags is not possible due to bad economic situation

Source: Expectations stated by the farmers during all group sessions and interviews, content analysis of transcripts; The black text in the table shows innovation-specific outcome expectations, the blue text indicates more general, process-related outcome expectations.

Before the implementation process of an innovation starts people tend to have expectations (presented in the left column), whether realistic or not. They are often generalized due to difficulties in perceiving possible unknown changes and outcomes innovations may bring.

M: "I expect to make progress, to get development."
Processing group session (1.A1-1), Changarawe; M: Male group member

M: "There are so many thing, but the main thing that drives us is to get rid of poverty, to come from the level we are in now to the next level, that we could be able to send our children to school."
Processing group session (1.A1-1), Changarawe; M: Male group member

Expectations of farmers, reflecting their beliefs and wishes during the ongoing implementation process (presented in the right column of Table 8), refer often more specifically to detailed aspects of the innovation system, whether realistic or not.

M: "Yes in five years, the education will have spread even in the neighbouring villages. If we farm in baby plots and there is a lot more harvest, then a person does not need ten acres to farm, so one only needs two to three acres and the rest we conserve the forests."
Micro-dosing group session (16.1AB-6), Ilakala; M: Male group member

As indicated in Table 8, the CL groups (bike and water pump) had more process-related expectations than innovation-specific ones. This is most likely due to the fact that these groups were already existing before innovation implementation, therefore group members' expectations regarding the group and the process seem to be more important for them.

3.3.2 Innovation Groups' actual innovation outcomes under most frequently named outcome themes

The six IGs named, altogether, fourteen outcome themes that categorize different innovation outcomes experienced by the farmers since the implementation of their different innovations. The names of the outcome themes (that the farmers devised during group sessions) and the criteria of outcomes to be considered under a certain theme are as follows in Table 9.

Table 9: Names and definition of outcome themes as stated by the farmers

Outcome themes	Outcomes belonging to theme are indicated through changes in ...
Time	duration farmers' need for a certain activity, time management
Knowledge ¹³	knowledge to implement an innovation and to be able to deal with innovation related challenges
Money	farmers' financial status/ situation
DCC	farmers' dependency (vulnerability) on (environmental) climatic conditions
Group	farmer group structure, function, and unity
Food	farmers' possibilities to access food
Energy	farmers' physical effort to do certain activity
Forest	farmers' habits of deforestation and forest protection
Health	farmers' experience on their health status/ state of health
Transport	farmers' means of transportation
Firewood	farmers' firewood consumption
Smoke	farmers exposed to smoke during cooking
Respect	respect given to the farmers
School	Possibilities to send children to school

Source: Outcome themes stated by farmers and collaboratively defined during group sessions

Table 10 gives a short overview of the outcome themes considered relevant by the members of the different innovation groups.

Table 10: Overview of farmer's actual innovation outcomes categorized under outcome themes

Group	Time	Money	Knowledge	DCC	Group	Food	Energy	Forest	Health	Transport	Firewood	Smoke	Respect	School
Processing	X	X							X				X	X
Bike	X	X	X							X				
MD	X		X	X	X		X	X						
Pump	X	X	X	X	X	X	X							
Stove	X	X	X					X			X	X		
KG	X	X	X	X		X								
n	6	5	5	3	2	2	2	2	1	1	1	1	1	1

Source: Outcome themes stated by farmers during group session (1.1A-1; 7.1C-4; 15.2C-5; 16.1AB-6; 22.3C-7; 23.2AB-8); n: number of groups

¹³ Farmers stated "elimu" which is the Swahili term for knowledge, but also means education

The outcomes experienced by the farmers associated with the three most frequently discovered outcome themes, which as shown in Table 10 were “Time”, “Knowledge”, and “Money”, are displayed and explained in detail below. Outcomes experienced by the farmers are distinguished by:

- Direct outcomes: outcomes that are directly related to innovation implementation; outcomes solely due to innovation
- Indirect outcomes: outcomes that are indirectly related to innovation implementation; outcome (quality) is influenced by the innovation process

The different innovations brought notable changes regarding the duration of certain activities in all six groups. Those outcomes of all groups that are categorized as outcome theme “Time” are summarized in Table 11 and sorted in relation to whether the innovation implementation reduced or increased farmers’ workload regarding time. In the left column activities are stated which result in time-saving, in the right column activities are listed that leads to additional time-spending.

Table 11: Overview of outcome theme “Time”, in terms of saving or spending farmers’ time

UPS or CL group	Time saving (through...)	Time spending (through...)
Improved Maize Processing	<ul style="list-style-type: none"> - less time intensive manual work (shelling was done by women, children) - fast and simple mechanized processing of big amounts, directly at the fields - service for people (who can afford it,) to reduce their work load - less transportation load (only grains) - alternating shifts of two sub groups, (free-time in between) 	<ul style="list-style-type: none"> - heavy machine that is pushed by manpower to far away fields (very time demanding) - (distance which people from sub-villages need to travel to fetch the machine) - Not all fields are accessible when machine is pushed manually (due to distance or slope) , for those transportation load remains)
Upendo: Bike rental business	<ul style="list-style-type: none"> - faster travelling and easier transportation compared to walking - accessibility of different markets in less time than by foot 	<ul style="list-style-type: none"> - rental service which needs to be done daily (someone hired) - bike reparation and regular maintenance service - effort to get customers payments - group meetings
Rainwater harvesting & Fertiliser micro-dosing	<ul style="list-style-type: none"> - farming of “unfertile” land nearby HH, cause less effort to clear and travel to far away fields - better yields on smaller pieces of land; no need to farm big areas - less manual work load to prepare smaller tied ridges/ beds as in traditional way (big beds) 	<ul style="list-style-type: none"> - group Meetings
Tuamiho: Irrigation water pump	<ul style="list-style-type: none"> - faster irrigation of group farm - irrigation of whole field in half a day by one person, (instead of two half days by whole group) - faster planting and weeding in soft soil, work can be done independent of 	<ul style="list-style-type: none"> - difficulties to find suitable farmland (nearby river, but not easily flooded) - transportation of heavy pump to the field

	precipitation events	
Improved Cooking Stoves (ICS)	<ul style="list-style-type: none"> - faster cooking, because of two cooking plates and remaining heat - higher fuel efficiency - less firewood collection 	<ul style="list-style-type: none"> - disfunction of stove; fire needs long time to get started - time demanding stove construction - group meetings
HH nutrition education & Kitchen garden training	<ul style="list-style-type: none"> - training to cook leafy vegetables in shorter time (to remain nutrients) - Kitchen Garden nearby house: Cultivation, irrigation and harvest easier and faster than collecting wild growing vegetables or go to a garden which is further away 	<ul style="list-style-type: none"> - irrigation in dry season (due to water scarcity are sometimes long queues at wells, or digging for water in dried river beds)

Source: Content analysis of all audio recorded and transcribed group sessions and interviews (see Annex 1)

The content of Table11 shows clearly that the innovation implementation led to savings as well as additional spending of farmers' time within all six groups. According to the micro-dosing group members, the time saving due to innovation implementation was immense and more than compensated for the time spent, as they claimed to farm much more efficiently as a result, as described below.

M: *"Now we use less time than before, because last period, people were going very far to get large farms, because we didn't know with (adding) just little fertilizer this small farms could produce a lot more. We are harvesting more than we used to do there (on bigger fields) before."*

Micro-dosing group session (16.1AB-6), Ilakala; M. Male farmer of micro-dosing group

M: *"In terms of time saving, just to add, it is true. The big beds (as done before) waste a lot of our time and you realize you have only farmed a small portion and also we get a lot of losses because you dig a lot and you end up planting on soil that does not have nutrients at all. You end up wasting a lot of time for digging a big portion of land."*

Micro-dosing group session (16.1AB-6), Ilakala; M. Male farmer of micro-dosing group

For the processing group the time saving, especially for women and children was crucial as the responsibility for the task (threshing maize by hand) is taken away from them and transferred to the men, who are now spending time operating the machine.

Table11 shows the essence of outcomes regarding time, but when outcomes are explained in detail, it becomes clear that outcomes are also inter-connected with outcomes of other outcome themes. For example, the pushing process of the maize sheller is very time (and energy) demanding. For those particular farmers, the costs and the work load of transportation remains, even though the principle aim to reduce this burden (by of owning a portable machine) had been intended.

F: *"Why you don't set up the machine in one place and people bring the maize there? Like the machine for producing flour, I don't think they go to every house. They are set up in one place and people carry their maize and take it to where the machine is. So as you await the tractor, do you think you can do that?"*

M1: *"That solution is not easy because, the purpose of the portable machine was to set the community free and reduce the cost of the farmers. So if they have to harvest the maize, carry it to that place (where the machine is) and then take it back, it takes long time and the cost will be too high."*

M2: *"Yea, it would even be better if they (women) did it (threshing) by hands."*

Feedback session (30.FB-2), Changarawe F: Female farmer from another group; M1+2: Male farmers from processing group

Upendo, the group running the bike rental business, is saving time through the usage of the bikes according to their daily traveling and transportation needs, even though it has to be remarked that some group members own their individual bikes and the group bikes have to be rented even by group members. On the other hand, the recording of the income and expenses is time consuming, especially because customers tend to not pay the full rental fee directly, as remarked in the quote below.

M: “A challenge is that our customers don’t pay on time. You will find a person has taken the bicycle and stayed with it for a month or week and when they come to pay, they don’t pay or they don’t pay the full amount of money. They come today, pay half, after two days, pay half the money again until they finish the debt. So that also reduces the income because they don’t pay on time. If it is 100 000 (TZS), they can’t pay at a go, they pay in four instalments. So that increase the work load, to (spend time to go and) look for those people, or decrease the income.”

Feedback session (30.FB-2), Changarawe, M: Male member of Upendo group doing bike rental business

M: “I went to collect the groups financial report. (..) I could find there are many debts. If we collect this, it can be 200,000 (TZS) and we have agreed to follow up those customers.”

Semi-structured interview (14.SSI-10) with male group member (secretary) of Upendo group doing bike rental business

This inter-connection of outcomes, as notable in the last two examples concerning outcome themes “Time” and “Money”, will be further investigated by integrating Table 12.

Table 12: Representation of outcomes categorized in outcome theme “Money”, distinguished by outcomes causing financial advantage or disadvantage to the farmers

UPS or CL group	Financial advantage (through.../ because of...)	Financial disadvantage (through.../ because of...)
Improved Maize Processing	<ul style="list-style-type: none"> - processing as employment and income source for men (family) - less transportation costs, if only processed maize in transported from the field - other income generating, or subsistence activities through lower workload of maize processing - 5 200 000 TZS group loan to purchase the processing machine 	<ul style="list-style-type: none"> - Fee for mechanical processing (3000 TZS/ 100kg maize) - unequal possibilities of income generation between sub-groups (explained in detail in the text) - monetary group contributions - poor farming season was the groups income lower than expected (to pay back loan)
Bike rental business (Upendo)	<ul style="list-style-type: none"> - income generated by bike rental service - Action fund (see 2.1) donated by the project to start bike business group has a credit and saving scheme - group received government loan after its formation 	<ul style="list-style-type: none"> - employment of a non-member to do bike business - fraud of employee and distrust within the group - investments needed to be done for bike storage - debts of customers need to be settled up - costly bicycle maintenance - monetary group contributions - business training very costly
Irrigation water pump	<ul style="list-style-type: none"> - higher yields through pump irrigation 	<ul style="list-style-type: none"> - costs for pump operation and maintenance (oil, petrol) - costs if vehicle is rented for pump

(Tuamiho)	<ul style="list-style-type: none"> - members receive food from group farm, which has not to be payed - marketing of group farm products for income generation - compensation payments of livestock keepers - financial means donated by the project to purchase the water pump 	<ul style="list-style-type: none"> transportation - most group farm products of the last season were severely infested by <i>Kantangaze</i>¹⁴ and therefore not marketable - this season heavy rains destroyed crops of group farm - marketing of products is difficult (market access, distributors) - investments for agricultural inputs (pesticides, fertilizer)
Improved Cooking Stoves	<ul style="list-style-type: none"> - (little) income for stove constructor - Construction fee is groups source of income - lower firewood consumption for the fuel efficient ICS, less money need to be spend to purchase firewood - more time for income generating activities through less firewood collection 	<ul style="list-style-type: none"> - constructors share of construction fee is not paying of the effort - private activities are considered to be more beneficial than group work - some customers can't afford even the low construction fee - costly group registration process - the group could not establish a saving and credit scheme to support the members
HH nutrition education & Kitchen garden training	<ul style="list-style-type: none"> - income can be generated by marketing of vegetable surpluses - own vegetable cultivation lowers food expenses - seeds (and pesticides) provided by the project 	<ul style="list-style-type: none"> - if water needs to be purchased in dry season

Source: Content analysis of all audio recorded and transcribed group sessions and interviews; (Rainwater harvesting & Fertiliser micro-dosing group is not mentioned in the table, as "Money" was not named as innovation outcome by this farmer group)

As stated in Table 12, all groups experienced financial advantages as well as disadvantages through the implementation of their innovations. The financial disadvantage is considered minor in the kitchen garden group as the benefits outweigh the spending in most cases. The aim of kitchen garden is to provide people with fresh leafy-vegetables even during the dry season, but for most farmers' income generation through marketing of their vegetables is of high importance for the group members.

F: "during dry seasons I have managed to sell (vegetables) and buy flour (staple food to feed family)." Kitchen Garden Group session (23.2AB-8); F. Female group member

However, it is necessary to cultivate more than one kitchen garden bag to enable the farmer to also sell vegetables from kitchen gardens for income generation.

¹⁴ *Tuta absoluta*: The tomato leafminer is a devastating pest of tomato and other Solanaceae that may cause a yield loss of 100%. It originates from South America, but is recently invading East Africa (Desneux et al., 2010; Izlar, 2015). *Tuta absoluta* is called "Kantangaze" in Swahili which is a very bad connoted word meaning "gangster" or "mafia". This pest is severely restricting the innovation outcomes which were potentially achieved through improved irrigation.

F: *“If you have one bag it is enough for your family only. So, the reason why we don’t get money is because we have few kitchen garden bags, but if you have like 20 (bags) you will get money, but due to few bags we can’t get money and sometimes even our family cannot get enough (vegetables).”*

Feedback session (29.FB-1), Ilolo; F: Female farmer from kitchen garden group

Especially the poorer members cannot effort to maintain more than one bag, as the water to irrigate has to be paid for.

F: *“I don’t have money for water to irrigate 10 or 20 kitchen garden bags. I only have power to irrigate only one bag so I cannot manage (to have more bags). so the challenge is due to economy (poor economic status of people) people cannot get money to maintain 10 or 20 bags.”*

Feedback session (29. FB-1), Ilolo, F: Female farmer from kitchen garden group

In the stove group, the members who use the stove on a regular basis noticed that they have less expenditure to buy fuel wood¹⁵, as cooking with the stove is more fuelwood efficient than using the three-stones¹⁶.

F: *“We are now using less firewood with the improved stoves (than before, cooking with three-stone). I have saved a lot and I can use the money in other budget.”*

Stove group session (22.3C-7); F: Female member

On the other hand, income generation through the fee for stove construction is not considered as sufficient by the group members, even though they formerly agreed on the amount, which was recommended to them by delegates from the project.

F: *“When I’m going to build a stove to another person I’m wasting my time. (..) Sometimes I don’t get even two thousand (construction fee). I better make a kitchen garden or cut firewood so that I get money.”*

Feedback session (29.FB-1), Ilolo; F: Female group member of stove group

In the processing group, through the mechanization of the maize shelling, the formerly unpaid domestic labour, mainly done manually by women and children, shifted to paid labour for men operating the machine.

M: *“Through the processing men have employment. Now, he gets extra income. So in the family generally, when a father has money the whole family, all will have money.”*

Processing group session (3.1B-3); Changarawe; M: male group member

F: *“We can say women are the one of whom the burden is reduced, but they (female group members) don’t benefit from the income of the threshing group. Even those (women) who are not in the group, they call us to thresh their maize, wherefore their workload is reduced, too.”*

Semi structured interview (6.SSI-3) with female processing group member, Changarawe

Differences within this group are not only due to gender, as there are also unequal possibilities of income generation between the two sub-groups into which the group members are divided, as follows:

F: *“What I face is that, in our group there are 16 members, and we divided ourselves into two sub-groups, one group thresh this week the other group will thresh the next week. And while you’re threshing, there is some money you earn, some amount will go to the group, the other will be divided among the working members. Now, that amount will be high when you get customers with more maize, now my problem started: The other (sub-)group, in which I’m not in, its members are those with high understanding, (..) they are more knowledgeable. They are the one who choose themselves, and we, the remaining, form the other group. Now,*

¹⁵ (if fuelwood is purchased; if fuel wood is collected, it leads to time saving, or additional income if this firewood is sold).

¹⁶ Three-stone stove: Traditional way of cooking on open fire between three stones on which the pot can be place.

since they know more famous people who have big farms, they tell them not to thresh on our weeks, they should wait and thresh on their week.”

T: “Why did you form two sub-groups, when you’re already in a group? Why you form two groups in a group?”

F: “Because we’re many in the group, we are sixteen. If we don’t divide in two sub-group, all of us have to work at the same time. It gives you a chance to do your other activities and even the amount of money after the distribution (between all members) will be so small.”

Semi structured interview (6.SSI-3) with female (F) processing group member and translator (T), Changarawe

Furthermore, the group stated that the whole progress of the group is restricted by their financial capital to purchase means of transportation, to be able to reach more customers.

M: “We are lacking money to buy a tractor to transport the machine so that we are able to reach more customers. Therefore, we are unable to have more income.”

Feedback session (30.FB-2), Changarawe; M: Male farmer from processing group

Other outcomes referring to outcome theme “money” will be elaborated in the following sections. The third most frequently named outcome theme for all the IGs was “knowledge” which is summarized in Table 13 as follows.

Table 13: Overview of outcome theme “Knowledge”, distinguished by gained knowledge, perceived lack of knowledge, or knowledge wanted by the farmers

UPS or CL group	Knowledge gained (through...)	lack of knowledge (because...)
Upendo: Bike renting business	<ul style="list-style-type: none"> - learning by doing, because group started farm without training - Received training on: <ul style="list-style-type: none"> o how to run bike business o how to do PM&E of the group work o bike repairing and maintenance 	<ul style="list-style-type: none"> - Received training: <ul style="list-style-type: none"> o did not include farming practice o and group management o on bike business was not sufficient according to farmers
Rainwater harvesting & Fertiliser micro-dosing	<ul style="list-style-type: none"> - Received training on: <ul style="list-style-type: none"> o how to apply new farming technique “practice of modern farming” o possibility and importance to mitigate deforestation (introduction of alternative to “slash and burn” practice) - continuous supervision on farm by extension officer - knowledge exchange among villagers / implementers - immediate practical implemented on the field - observation of mother plot for comparison 	<ul style="list-style-type: none"> - Received training: <ul style="list-style-type: none"> o was only for limited number of people o was not sufficient for new members o was too short/fast especially for old members o did not include group management - limited information flow within the group - limited knowledge exchange among villagers/families - (Villagers are not included in measures to mitigate deforestation)
Tuamiho: Irrigation water pump	<ul style="list-style-type: none"> - received training on: <ul style="list-style-type: none"> o group structure and collaboration o how to do PM&E of the group work o usage and maintenance of pump o Horticulture/gardening (tomato cultivation, pesticide application, 	<ul style="list-style-type: none"> - Received training: <ul style="list-style-type: none"> o did not include pest management of “Kantangaze” o on horticultural practice <p>was not comprehensive according to farmers</p>

	fertilization)	
Improved Cooking Stoves (ICS)	<ul style="list-style-type: none"> - received training on: <ul style="list-style-type: none"> o stove construction (two members were trained to train the other group members) o how to do PM&E of the group work o stove usage - knowledge exchange among implementers - construction skills are forwarded in the group 	<ul style="list-style-type: none"> - Received training: <ul style="list-style-type: none"> o was only for limited number of people (Intense construction training just for two group members) o was not sufficient for other members - limited knowledge exchange among group members (limited construction skills of most members)
HH nutrition education & Kitchen garden training	<ul style="list-style-type: none"> - received training on: <ul style="list-style-type: none"> o HH nutrition (balanced diet, food preparation) (two members were trained to train the other group members) o Kitchen garden bag preparation - Knowledge (of construction and usage) exchange among implementers 	<ul style="list-style-type: none"> - Received training: <ul style="list-style-type: none"> o on maintenance of bags o and plant treatments (pesticide application) was not sufficient o did not include organic farming practice o and seed propagation

Source: Content analysis of all audio recorded and transcribed group sessions and interviews; (Improved Maize Processing group is not in the table, as “Knowledge” was not named as innovation outcome by this farmer group)

As shown in Table 13 all five groups, which experienced outcomes in the outcome theme “Knowledge”, gained knowledge by the implementation process, but also still perceived a lack of knowledge regarding their innovation process. Members of the micro-dosing group mentioned that they learned through the training they received that a change of their farming practice (away from slash and burn) may be a possibility to mitigate deforestation.

M: *The kind of education that we have received changed our view. We were clearing forests to farm, but since they brought this knowledge of modern farming, you just farm two acres of land and you get maximum results. We were cutting down trees to get big farms that did not have any benefits.”*

Micro-dosing group session (16.1AB-6), Ilakala; M: Male farmer of micro-dosing group

Members of the pump group stated that they gained a lot of useful knowledge to be able to handle the water pump and to improve their farming practice. However, the biggest challenge in the last season was due to a new tomato pest which is invading their area just recently.

M: *“There was problem in the last season. It is a new challenging pest which is called “Kantangaze”. We had no way to get rid of it, wherefore the harvest was so poor. We had to select the tomatoes that were not affected severely for food, but even for those you will not get money because you can't sell them. When we harvested ten buckets there remained only one bucket (of tomatoes) with good quality.”*

Water pump group session (15.2C-5), Ilakala; M: Male group member

This lack of knowledge on how to deal with this new pest caused devastating income losses and diminished the additional food the members received from the group farm.

M: *“We have field officers around here so when we face small problems we approach them, but for the big issues like the disease it is a problem, they couldn't help us. By the way, even its name “Kantangaze” it is so irritating.”*

Water Pump group session (15.2C-5), Ilakala; M: Male group member

M: *“We received not so much food from our fields and got a very little income and most of it ended in petrol,*

so I am not satisfied, and it is mainly due to this "kantangaze" parasite."

Water Pump group session (15.2C-5), Ilakala; M: Male group member

A main problem of the stove group members regarding outcomes concerning knowledge was due to knowledge dissemination within the group. Even though group members were trained in stove construction and usage, to pass this knowledge to their fellows, most group members did not know how to build or repair the stoves.

F: *"Those people who are saying they know how to build a stove, if you take an individual he cannot complete (a stove) alone. Some know how to prepare clay; some they don't know how to measure centimetre, so we need the education for them to understand. So, that if you call one member he/she can make a stove from scratch up to finish. If they don't know the centimetres and how to use clay... We are supposed to be good teachers, therefore group members should know everything, including measurement."*

Stove group session (22.3C-7), Ilolo; F: Female group member

F: *"They came and build a stove for me. In that way I should learn to build a stove for another person. That is why am saying: I don't have education. I don't know how to use the tools, to be able to build a stove for another person."*

Feedback session (29.FB-1), Ilolo; F: Female member of stove group

On the other hand, within the stove group, other members claimed that their experience with knowledge dissemination regarding stove construction and usage among the group members worked well.

F1: *"The first day I was taught how to build a stove, the second day I forget, because I didn't understand. So I saw again those who were group founders they taught me to make one (stove) and the other one I did myself."*

F2: *"My stove was not working and I was using wet and small firewood. Later, I spoke with those who attended seminar and they told me to use dry and big firewood and when I used this it started cooking well."*

Feedback session (29.FB-1), Ilolo_F1+2: Female members of stove group

The kitchen garden group members stated that the knowledge they gained within the innovation process made them able to build KG bags and to cultivate their vegetables.

M: *"We are satisfied with the knowledge we got, because we have vegetables, the rest is now additional. Yes, we need to be trained how to use pesticides. Every member was trained to make the kitchen garden and we all know how to make it; now we have that knowledge, so it's coming step by step."*

Kitchen garden group session (23.2AB-8), Ilolo; M: Male group member

During the group session, it was stated that only the Agricultural Extension Officers (AEO) apply pesticides on their KG vegetables when they are requested to do so. The members explained that those AEOs do not appear immediately, therefore they would like to be able to use pesticides on their own.

F: *"To use pesticide, we were not trained. They were saying that pesticides and seeds are supposed to be used by officers in this region (who are in charge of the project here). So when we have that challenge, you just call the officer and he come to spray for you; and even for seeds, they were the one distributing. So we were not taught about pesticides, only the officers. If it would be possible for us to get the training from the officer, it could be better. Because, we might observe the vegetable are affected and when you look for that person (AEO), it is not easy to get him. So your vegetable will be still destroyed, that is the work of the officer."*

Kitchen garden group session (23.2AB-8), Ilolo; F: Female group member

When the farmers were asked how they perceive such chemical treatments on vegetables for their direct consumption, next to their door step, where the children are in direct contact with the plants, a female farmer replied:

F: *"It is not good to use such chemicals on the vegetables, that is why, when we meet in our meeting, we discussed that if you see a hole in your vegetable it is important to use "traditional pesticide", instead of waiting for them to spray. We have ash, when you use fire, this ash, if you spray it directly when you notice the pest, it will not eat again. So special (synthetic) pesticides, they are not good. Maybe she can tell us what*

they use instead of pesticide.” Kitchen garden group session (23.2AB-8), Ilolo; F: Female group member

This statement shows that plant protection issues were previously discussed within the group. However, this topic is critical as the KG vegetables are introduced to benefit peoples health by provision of fresh vegetables to have a more balanced diet, rich in micronutrients. Pesticide treatment poses high risks in itself, which may cause harmful instead of beneficial effects through the introduction of KGs.

The IGs’ *outcome themes* as presented in Table 1 were in some cases very specific. For a better comparison of the outcomes of different innovations with the intended innovation outcomes, themes are summarized through integration into the five *outcome domains* (as explained in section 3.2). This way of presenting the findings makes it possible to analyse which dimensions of farmers’ lives were influenced by the various outcomes.

Some outcome themes, as named by the farmers, cannot clearly be clustered in only one outcome domain and therefore some themes are assigned to multiple domains. The farmers’ outcome themes summarized as the “Physical” outcome domain are all outcome themes that relate to physical labour, including outcome theme “Energy”, “Time”, “Transport¹⁷” and “Firewood¹⁸”. As those outcome themes are challenging farmers’ physical abilities, these also comprise factors influencing farmers’ physical well-being. Also, outcome themes “Health”, “Smoke” and “Food” are categories of outcomes which have huge influence on farmers’ physical well-being.

In the “Intellectual” outcome domain are outcome themes like “Knowledge” and “School” summarized. Within the financial domain are the outcome themes “Money”, “Food¹⁹”, “Transport²⁰”, “Firewood²¹” and “School²²” included. The Environmental domain consists of outcome themes “Firewood”, “Forest”, and “Dependence on climatic conditions (DCC)”. Such as the outcome theme “School” which is part of the “Financial” and as well as the “Intellectual” domain.

3.3.3 The farmers’ prioritization and valuation of innovation outcomes

The outcome ranking was done by the farmers within the group sessions. In the six groups, farmers chose their individually prioritized innovation outcome theme and stated at least one specific outcome within that section, to explain their choice. Through analysis of those individual selections, a ranking of the outcome domains is done in

¹⁷ Referring to the work of carrying materials and goods over a certain distance

¹⁸ Referring to the work of collecting firewood;

¹⁹ Referring to food items which can be sold for income generation, or which have to be purchased if not available

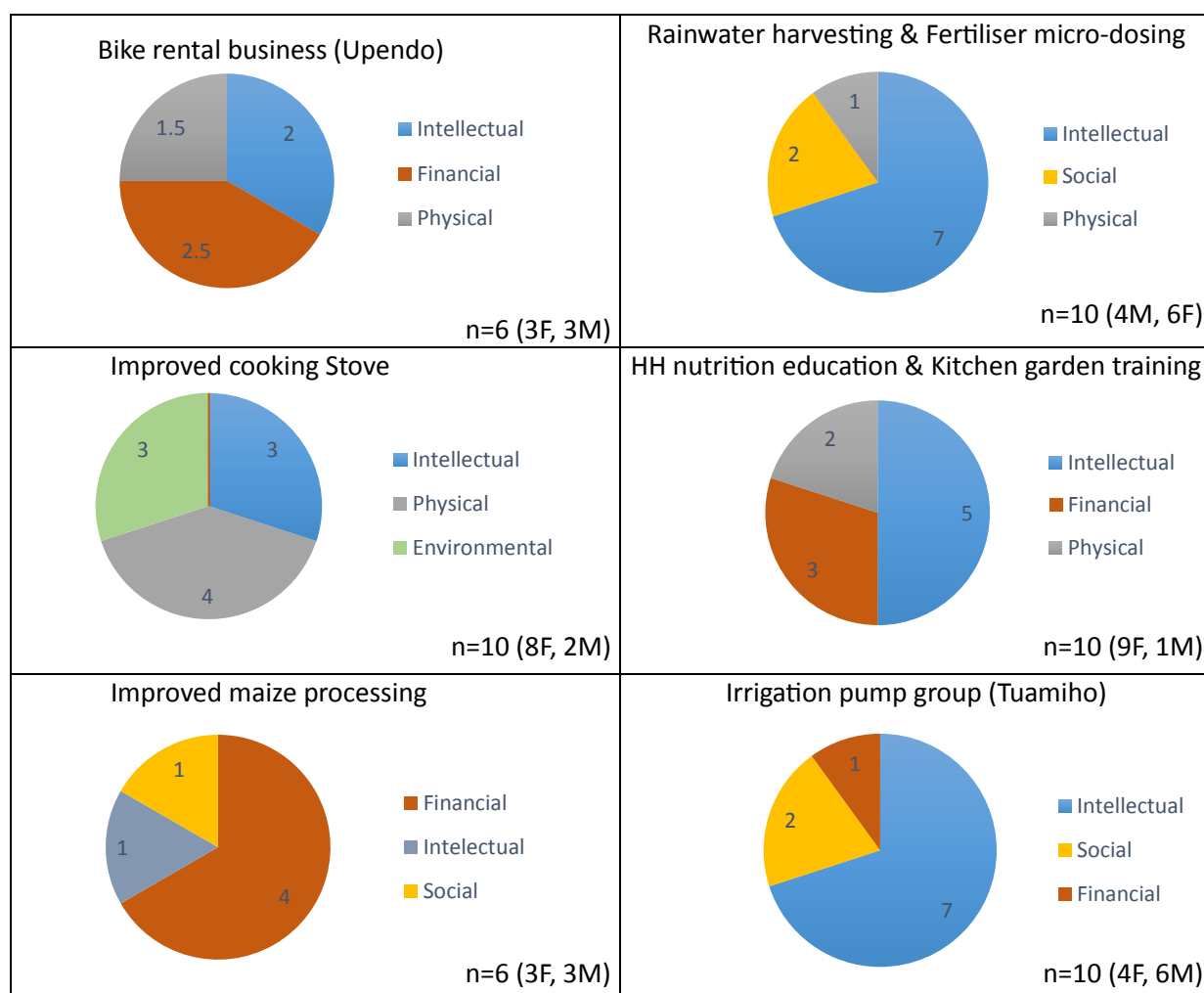
²⁰ Referring to costs caused through means of transportation, like service or petrol

²¹ Referring to fuel wood when purchased

²² Referring to school fees

Figure8, to provide an overview of changes due to innovation outcomes, which are prioritized by the groups.

Figure 8: Visualization of prioritized outcomes expressed in outcome domains



Source: Outcome ranking conducted within group sessions; n = number of participating group members; F= number of female members; M= number of male members;

Figure 8 indicates that farmers' valuation of outcomes related to their intellectual well-being (blue) was high in all six groups. Also, outcomes assigned to "Physical" (green), as well as "Financial" outcome domain were prioritized by individual farmers in four groups. When farmers' valuation of outcomes assigned to certain outcome domains is aligned with the outcome domains in which changes were experienced and/or intended, the prioritization of members of the micro-dosing group appears quite surprising. The outcome themes that the group members prioritized most frequently are assigned to the "Intellectual" as well as the "Social" domain, which are domains where initially no changes have been intended.

Figure 9: Share (in %) of prioritized outcomes of all farmers from the six innovation groups expressed in outcome domains

Table 14 presents an overview of the share of outcome domains that comprise the prioritized outcomes of all 52 farmers who conducted the outcome ranking. This clearly identifies the high valuation of outcomes that affect farmers intellectual well-being such as the possibility to gain relevant knowledge. Outcomes assigned to the "Financial", "Physical" as well as "Social" outcome domain were also prioritized by the farmers, but in sum not as much as the "Intellectual" domain that make up 48% of overall the prioritized outcomes. Table 14 provides an insight into which specific outcomes are prioritized by the IG members of those four groups and why.

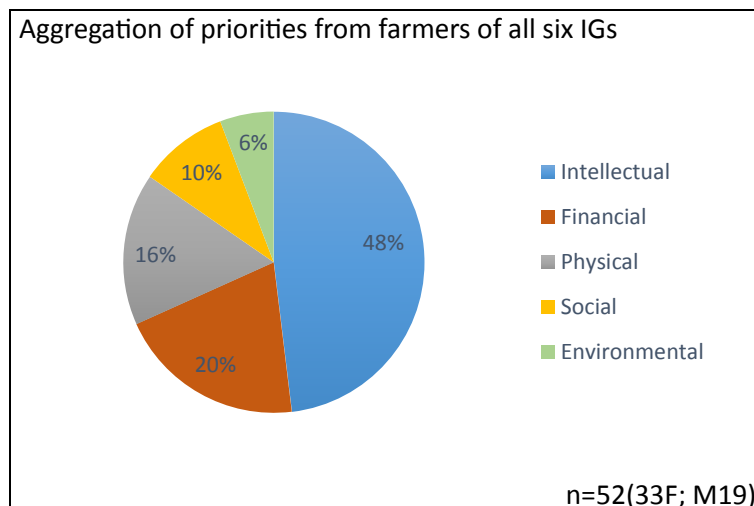


Table 14 Farmers selection of prioritized outcome themes with stated reasons

UPS or CL group	n prioritizing: Outcome theme	Group members' reason(s) for prioritization (Stated by: F: Female; M: Male) (Farmer prioritized outcome theme, because...)
Bike rental business (Upendo) n=6	2: Knowledge	- F: money can be spent, knowledge stays - F: knowledge about farming, and business is crucial
	2: Money	- M: with money it is easy to access/purchase everything; - M: financial success of the group will lead to other beneficial outcomes
	1: Transport	- F: bikes helps to run business through better market access
	1: Time	- M: time is needed for own activities
Rainwater harvesting & Fertiliser micro-dosing n=10 (4M, 6F)	7: Knowledge	- M: knowledge is the basis to reach other outcomes - M: with the gained knowledge others can be trained - M: he is attracted by education - F: the gained knowledge shall be broadened/extended for her and her family - F: she wants to join the group to gain beneficial knowledge of group members - F: she wants to gain more knowledge for further progress

		- F: the knowledge about new farming practice has brought benefits
	2: Group	- M: through group unity the knowledge can be disseminated to others - F: group unity and harmony is very important
	1: Energy	- F: it is important for farmers to save their energy
Improved cooking Stoves n=10 (8F, 2M)	3: Knowledge	- M: he acquired everything through education and would like to continue learning - F: received training helped to solve problems - F: knowledge is the key of life, which enables to receive all other things
	3: Time	- M: fast cooking is very beneficial - F: cooking on two plates make it fast and simple - F: faster food preparation saves fuelwood
	2: Forest	- F: trees are beneficial for the environment as fuelwood and as source of income - F: people benefit a lot from the forest that's why they should protect it
	1: Firewood	- F: there is not much firewood left to collect; the stove does need less firewood, money can be used to buy other things
	1: Smoke	- F: smoke is going outside and it help to reduce many things like chest and eye problems and is better for the environment
HH nutrition education & Kitchen garden training n=10 (9F, 1M)	5: Knowledge	- F: knowledge makes it possible to do effective vegetable cultivation on small space, - F: it is good to have knowledge about benefits of vegetable consumption - F: she is thankful for the received training and want to add bags - 2 F: they got skills to build the bags
	3: Money	- F: KG has reduced the budget which is spend for vegetables (money could have been rated in that case) - F: less HH money is spent for vegetables - F: budget share to buy vegetables is reduced - F: there is no need to cut and sell firewood to buy vegetables anymore
	2: Food	- M: balanced diet, improves health of family - F: vegetables are easy accessible at home in sufficient quantity

Source: Outcome ranking within group sessions; n= number of participants.

Table 14 clearly indicates that the outcome theme "Knowledge" was prioritized by at least 1/3 of the participating group members in each group. The high share of individuals in all four groups, stating that outcomes which improve their knowledge are most appreciated, shows that the groups' overall valuation of knowledge was high. In micro-dosing and kitchen garden group the members clearly

favoured outcomes assigned to the outcome theme “Knowledge”. In the stove group the same share of members prioritized “Knowledge” and “Time”, wherefore both are considered to be valued equally and in the bike group “Knowledge” was valued equally with outcome theme “Money”.

In all four groups, it was stated that knowledge is seen as a prerequisite to acquire other beneficial outcomes.

F: “Above all, education is the key in my life, because without education I will not plant trees; I will not know where to take my money and also how to manage my time. So, first I need education so that I know how to do all the other things, that is why the first thing for me is education.”

Stove group session (22.3C-7), Ilolo; F: Female group member

F: “Money can be spent, knowledge stays.”

Bike group session (7.1C-4), Changarawe; F: Female group member

It is remarkable that no member of the stove group prioritized the outcome theme “Money” even though “income generation” was an inherent part of the group discussions within the sessions. As already elaborated (Table 13), members of the group perceive the income which a stove constructor earns for conducted work as too low. The group members’ motivation to participate in group meetings, as well as other group activities, appeared driven by the wish to generate income, which will be investigated in more detail when farmers’ satisfaction regarding the outcome theme “Money” is presented in section 3.3.4.).

With the processing group, four rounds of outcome ranking sensitive to different socio-cultural factors were conducted. This was done with a small group of six participants in a short session. All participants were to think about themselves in different rounds as: a) men, b) women, c) better off, or d) without any formal education, and choose which outcome section might be the most important in that situation and why.

Table 15: Farmers of improved maize processing group: selection of prioritized outcome themes

Important for...	n prioritizing: Outcome theme	Group members’ reason(s) for prioritization (Stated by: F: Female; M: Male) n=6 (3F, 3M) (Farmer prioritized outcome theme, because...)
women	2: Money	F: with money she has access to medical treatments and can purchase what she needs F: women are suffering most when the HH budget is low
	2: Health	M: women take care of sick family members M: women were suffering a lot doing the physically demanding manual maize shelling
	1: Time	M: women have no time to rest as they used to work the whole day
	1: Respect	F: women did not get respect for the hard task of manual maize shelling
men	3: Money	M: working with the machine is a source of income to feed the family M: for everything you want to do you need to have money F: working with the machine is a source of income, which is beneficial for the family
	2: Respect	F: when people recognize that you work in the processing group they ask you for help; your reputation in the neighbourhood will increase F: when I have income I will be respected (better to consider under Money)
	1: School	M: as a man it is our responsibility to take children to school
people which are “better off”	6: School	T: the education of our kids need to be improved, that they have better chances in live
people without formal education	6: Money	M: farming to have a source of income is most important M: if there is no way to go to school again, money is everything M: If you have no education at all, you have to use your brain to find money to solve your problems F: you can’t survive without money; money is everything in this life F: money is everything, even if you need anything from somebody, if you

		don't have education you will have to buy it F: without education farming to get money is important
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Source: Outcome ranking within group session (3.1B-3); n= number of participants.

Table 15 clearly indicates that group members' prioritization of outcome themes differs according to gender aspects, even though outcome theme "Money" was valued high in both cases. Considering women and money, the focus was on their role in the family to economize the HH budget.

F: *"I choose income as a woman, because in a house with responsibilities, we are the one who suffer the most, when the income is low we're the one who are affected most, but having a machine, reducing the transport cost, I as a woman I got more money to cover the household budget."*

Processing group session (3.1B-3); Changarawe; F: Female group member

However, the focus of men, even from women's perspectives, was to be gainfully employed to generate income for the family, which increases his reputation, (which was expressed through "Respect" prioritized by women considering men)

F: *"Because, when we got the machine, my husband was getting some money which helps us. So earning money is everything."*

Processing group session (3.1B-3); Changarawe; F: Female group member

The outcome theme that was the second priority for women was "Health". Of note is that men were prioritizing health when they valued outcomes referring to women.

M: *"The hard work (of maize threshing) was done by women manually. Now, were doing it with the machine. Women can save their physical energy, save their time, and don't suffer anymore."*

Processing group session (3.1B-3); Changarawe; M: Male group member

This statement shows that this man is aware of the physical burden put on women when they are doing the manual maize shelling. Also, another man of the group emphasized the importance to unburden women of their responsibilities to have time for themselves.

M: *"I choose time because, women, from 6 in the morning, she was just working the whole day till night when she sleeps, but now with the machine reduces work load to her, she will at least settle, she will get time to rest."*

Processing group session (3.1B-3); Changarawe; M: Male group member

Even though those men of the group seemed to be aware of the situation of women regarding their workload, a female group member who prioritized "Respect" stated:

F: *"I put it on respect because, as we said, we were the one doing the work, you get very tired, men never did the job. When he gets back, I do not even get respect, like forces you to do the job, no respect, but now, there is a machine, there is more respect. I do not suffer anymore."*

Processing group session (3.1B-3); Changarawe; F: Female group member

What was remarkable is that, independent of gender, all members prioritized education for their children when they considered themselves as "better off" and valued "Money" highest for adult people with no formal education.

With the water pump group, the rating was disaggregated by gender. Two rounds were conducted in which the participants chose which outcome section they thought is most important either for: a) men or b) women. In these two adaptations, as explained in 2.6.3, the answers were given either according to personal background or hypothetically when the individual participant did not identify with the social groups they should consider.

Table16: Farmers' of irrigation pump group selection of prioritized outcome themes

Important for...	n prioritizing: Outcome theme	Group members' reason(s) for prioritization (Stated by: F: Female; M: Male) n=10 (6M, 4F) (Farmer prioritized outcome theme, because...)
women	6: Knowledge	M: knowledge is the basis to acquire all other things M: knowledge about farming helps group a lot M: knowledge about gardening helps to even to cultivate own garden M: everything comes from education M: without knowledge one is not able to do anything F: knowledge make it possible to manage all other things in life
	2: Group	F: the group make it possible to reach all other aims F: in the group ideas and knowledge are exchanged and members support each other
	1: Money	F: a poor woman needs money to improve life
	1: Time	M: more time to take care for the children is crucial
men	8: Knowledge	F: without knowledge you even don't get a job F: knowledge helps to understand things M: knowledge makes other things possible M: he enjoys education /training/ gaining knowledge M: without knowledge you can't do useful things M: knowledge about farming very beneficial M: things can just be done if there is knowledge about it M: knowledge offers solution for any problem, even to destroy "Kantangaze"
	1: Group:	F: the group makes it possible to get training and all the other things
	1: Energy	F: energy needs to be saved to be able to work beside the group farm

Source: Outcome ranking within group session (15.2C-5); n= number of participants.

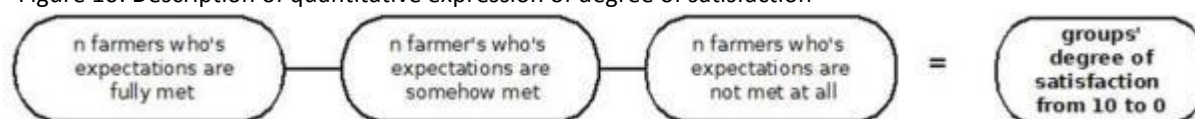
Table 16 indicates that group members' prioritization of outcome themes considering gender aspects is different, even though outcome theme "Knowledge" was valued very high in both cases. Also, outcome theme "Group" was prioritized by group members referring to both genders. What is remarkable is that the valuation of group related outcomes is ranked higher for females, done by females, and that it was also a female group member who prioritized outcome theme "Group" when considering men's priorities. This shows that women of this group value the outcomes that are assigned to the group more than men. The reasons stated by the group members, as to why they prioritized a special outcome of those two themes, were quite equal referring to both genders as stated in the table above.

3.3.4 Farmers' satisfaction regarding specific innovation outcomes

Within the conducted group sessions of four groups, namely *Micro-dosing, Pump, Stove and Kitchen Garden*, the farmers could express their individual satisfaction regarding different outcome themes.²³ The participants were invited to position themselves on an opinion line according to the extent to which their expectations of an outcome section were met. Subsequently, the farmers explained their perception of outcomes they experienced within a certain outcome theme. The farmers only chose three possibilities, both edges and the middle, along the line to position themselves.

The results of the opinion line of those four groups is displayed in numerical values in order to quantify and express the groups' degree of satisfaction on investigated innovation outcome themes. Due to the fact that in all cases ten people participated in the exercise the groups' degree of satisfaction is expressed on a scale from 10 (expectations fully met) to 0 (expectations not met at all). The values which are shown in Table 17 can be read as follows:

Figure 10: Description of quantitative expression of degree of satisfaction



Source: Author

The number of farmers displayed through the first value is calculated with factor 1, the second with factor 0,5 and the third value with factor 0 to calculate the group's degree of satisfaction which is displayed as fourth value in the row.

Table 17: Quantitative expression of farmer groups' overall degree of satisfaction (DOS) regarding their different outcome themes

Outcome theme (OT)	Micro-dosing	Pump	Stove	Kitchen Garden	Average DOS OT
Time	10-0-0=10	10-0-0=10	9-1-0= 9,5	10-0-0=10	9,9
Knowledge	5-2-3= 6	10-0-0=10	4-6-0= 7	10-0-0=10	8,3
Money	N/A	1-1-8= 1,5	1-8-1= 5	2-4-4= 4	3,5
Group	10-0-0=10	10-0-0=10	N/A	N/A	10,0
Energy	10-0-0=10	7-3-0= 8,5	N/A	N/A	9,3
DCC	3-4-3= 5	1-9-0= 5,5	N/A	8-2-0= 9	6,5
Food	N/A	6-2-2= 7	N/A	10-0-0=10	8,5
Forest	10-0-0=10	N/A	N/A	N/A	10,0
Firewood	N/A	N/A	9-1-0= 9,5	N/A	9,5
Smoke	N/A	N/A	9-1-0= 9,5	N/A	9,5
Average DOS	8,5	7,5	8,1	8,6	8,5

²³ Due to time constraints, the opinion line could not be (per)formed during the processing group session and the bike group session.

Source: 2 pictures of the conducted opinion lines within group sessions (16.1AB-6; 15.2C-5; 22.3C-7; 23.2AB-8); 0 = completely dissatisfied; 10 = completely satisfied.

The measured degree of satisfaction is not considered as a meaningful standalone image of the farmers' view as such. The quantification was done to prompt discussion about the correlation of farmers' selected position and their verbally stated opinions. Regarding the correlation of the 'degree of satisfaction' and the participants' statements (presented below), it can be said that they are not contradictory. However, the average 'degree of satisfaction' of all groups regarding all outcomes, is rather high at over 8 (on a scale from 1 to 10). This seems inflated when one takes farmers' explanations, statements and reasons for why their expectations regarding their innovation outcomes have (not) been met into account.

To give an insight in farmers' views, revealed through the opinion line, the following tables summarize and display the groups' degree of satisfaction on the left side and farmers' individual perception of outcomes as reasons for their satisfaction concerning different outcome themes on the right side.

Table18: Summary of micro-dosing group members' reasons for *degree of satisfaction* regarding different outcome themes

Outcome theme: Groups' degree of satisfaction	Reasons for farmers' individual degree of satisfaction (better to call it only: Farmers' opinions or farmers' perception of their innovation outcomes) (Farmer is (not) satisfied, because...)
Time: 10	<ul style="list-style-type: none"> - preparation of small beds on smaller fields is time saving - less time intense slash and burn needs to be done
Knowledge: 6	<ul style="list-style-type: none"> - new members have not received full training (two women) - representatives (3 women) have not received any training neither from project nor family members - not many women attend trainings themselves - the training is considered as good, but more is wanted - sometimes farmers get daily supervision by project partners - dissemination of knowledge within community (family, neighbours, even other villages) is well
DCC: 5	<ul style="list-style-type: none"> - they are still very dependent on the climatic conditions - the innovation did not help when floods came - in very hilly environment the water overflows the tied-ridges - innovation helps on hilly sight, to harvest rain water on the field - rwh does not work on flat ground - rwh helps the crops during dry season
Group: 10	<ul style="list-style-type: none"> - there is group harmony and support - there are no problems within the group - group members are patient with new group members - group brought beneficial changes
Energy: 10	<ul style="list-style-type: none"> - because small beds are easier to prepare
Forest: 10	<ul style="list-style-type: none"> - land was depleted without usage of fertilizers, can now still be farmed and farmers have stopped their plan to cut down forest

Source: pictures and content analysis of opinion line within group session (16.1AB-6)

As indicated in Table18 the farmers' satisfaction regarding their specific outcomes of certain outcome themes was very high for four out of six themes, which were "Time", "Group", "Energy" and "Forest". The outcome theme that the farmers referred to most critically is the "Dependence on Climatic Conditions". According to the farmers, they had recently experienced extreme weather conditions in form of floods. The innovation was indicated to be suitable to help farmers to deal with unsuitable/extreme weather conditions, as tie-ridges are introduced to mitigate erosion when there is high precipitation and to harvest rainwater *in situ* to improve soil moisture content in dry season. When the farmers were asked in how far their expectations have been met, to be able to better cope such environmental conditions a male farmer stated:

M: "I think the trenches are more suitable in times of dry season. In dry season, we harvest water and the crops are healthy compared to the times that you have not dug the trenches. But when it comes to water flows, it means, according to the height of the trenches, the water fills up until it breaks them. Even right now, if you were to visit my farm, you will see the tied ridges that I had made, have been washed away and

water flows out. So you will see that in dry season, the trenches are much more suitable because they take care of the crops and the yields are good. But in times of floods, it affects a lot. That is my opinion."

Micro-dosing group session (16.1AB-6), Ilakala; M: Male group member

This statement is representative for the experience of many farmers whose fields were destroyed by those extreme precipitation events.

A summary of the satisfaction of the pump group members concerning their experienced innovation outcomes is presented in 19 as follows:

Table 19: Summary irrigation pump group members' reasons for degree of satisfaction regarding different outcome themes

Outcome theme: Groups' degree of satisfaction	Reasons for farmers' individual degree of satisfaction (Farmer is (not) satisfied, because...)
Time: 10	<ul style="list-style-type: none"> - the pump saves a lot of time (pump irrigation: 1 person 6h, bucket irrigation: 8 persons 10h) - with the pump irrigation is much faster than irrigating by bucket - group members have scheduled shift for pump transportation and irrigation (then others have free time)
Knowledge: 10	<ul style="list-style-type: none"> - the received training about farming practice was good especially the plant protection part, (but additional training regarding <i>Kantangaze</i> is appreciated) - the already gained knowledge about pump usage is beneficial - group received good proper training on plant protection and field preparation - group receive help to solve small problems from extension officer
Money: 1,5	<ul style="list-style-type: none"> - only 10% of tomatoes were marketable, because of infestation with <i>Kantangaze</i>, which was not satisfactory at all - customer notice and request tomatoes when group advertise tomatoes at a bigger market - the expenditures for petrol and the pump maintenance is high compared to low income - the income increased through improved irrigation - there was no market nearby, even for little marketable harvest - the retail buyers dictated prices - because no capital for a car to transport harvest to the next market to generate income - there are expenditures for a motorcycle or bike to bring the pump to the field - group has not enough financial capital to solve problems - the new pesticide against <i>Kantangaze</i> is very costly
DCC: 5,5	<ul style="list-style-type: none"> - the pump is very helpful in to irrigate fields in dry season - the pump is performing well - the pump is not helpful in those times of unpredicted heavy rains
Food: 7	<ul style="list-style-type: none"> - group members get plenty of additional food during the harvest season - not as much additional food as it could be, because the crops are affected by pests - the harvest was poor and only 10% was not affected by pests

	<ul style="list-style-type: none"> - damaged fruits with low storage capacity
Group: 10	<ul style="list-style-type: none"> - group decisions are implemented quickly and group activities are done in time - all group members are treated equally within the group (tribalism, religion, politics, age are considered not considered as problem) - the group is good to exchange ideas in a good atmosphere - the group members respect the group's rules, like being punctual - there is support among group members in case of sickness and death - there is much love within the group
Energy: 8,5	<ul style="list-style-type: none"> - after she carried the heavy pump on her head, she suffered for two weeks - there are still no group means for pump transportation, and pump will be stolen if it stays near the field - a bike can be lent by a group member, but it is not always available - the pump irrigation is less demanding than manual irrigation - now is energy left for other, private activities

Source: Content analysis of audio recorded opinion line within group session (15.2C-5)

As presented in Table 19, the farmers' satisfaction regarding their specific outcomes of certain outcome themes was very high for three out of seven themes, which were "Time", "Knowledge" and "Group". The group members really emphasized their overall satisfaction with time being saved through the mechanized irrigation process. Also they appreciated their group unity and effectiveness, as well as the knowledge they gained through innovation implementation. The outcome theme which the farmers referred to most critically is "Money", in connection to the severe outbreak of a new pest, which occurred independently from innovation implementation, and decimated the harvest. Farmers' expectations regarding the innovation outcomes have not been met at all. Even though the incidence of the pest is clearly not innovation-specific, it severely restricted farmers' benefits, which is expressed by the following quote:

M1: *"Kantangaze is the problem which make things worse. We are farming well; when you look you will see the tomato is in good shape, but if you take a fruit and press a bit some watery material comes out. You will just wonder, where does the insect enter in? It is a really bad luck to us, that is why the income has been so low. Not satisfactory at all."*

Pump group session (15.2C-5), Ilakala; M: Male group member

Other challenges of the group referring to income generation were that the marketing of their farm products is difficult anyway, as the group does not have proper market access are also not innovation specific.

F: *"Another thing that was a problem is that, even those we got after selection, the best tomatoes from the affected ones, there was no market."*

Pump group session (15.2C-5), Ilakala; F: Female group member

The farmers stated that they are dependent on retail buyers that are dictating the prices to them or even don't appear, because to send their products to the next market²⁴ is to capital intense to them as explained below:

M: *"It depends, if you have enough capital, what you have to do is, to take a car to send your products there (to the market), but if your capital is small, like ours, you will depend on the customers to come here, but sometimes they even don't come."*

Pump group session (15.2C-5), Ilakala; M: Male group member

²⁴ Ulaya, which is half an hour drive by motorbike, but no one of the group owns one.

There is another issue bothering the group members, which is related to outcome theme “Money” as well as to the outcome theme “Energy”. It is the transportation of the pump to the field, described as follows:

F: *“We had an agreement for all group members to carry the machine in shifts, but the carry process is still a challenge, sometimes we can hire a motorcycle and we contribute on fuel to take it to the field and sometimes we carry it on heads.”*

Pump group session (15.2C-5), Ilakala; F: Female group member

Even though the group members stated that the irrigation process is now much easier which is saving farmers energy during the irrigation process, the physical burden of carrying the pump, if no means of transportation is available, is very high, as expressed by this woman:

F: *“When I come to energy I’m considering both sides, on irrigation and carrying the machine. I see my energy is more saved, because when I go to the farm, and get back I still have energy and I can do my other activities, different than before irrigating by bucket, I was very exhausted. But there was a time I carried the machine on my head, I suffered for two weeks. “*

Pump group session (15.2C-5), Ilakala; F: Female group member

Next, a summary of the satisfaction of the stove group members concerning their experienced innovation outcomes is presented as follows:

Table 12: Summary of stove group members’ reasons for degree of satisfaction regarding different outcome themes

Outcome theme: Groups’ degree of satisfaction	Reasons for farmers’ individual degree of satisfaction (Farmer is (not) satisfied, because...)
Time: 9,5	<ul style="list-style-type: none"> - cooking on two plates at the same time makes cooking faster with less firewood demand - less time is spent for firewood collection - stove cooks fast as long as dry firewood is used and stove construction is proper
Knowledge: 7	<ul style="list-style-type: none"> - only two people received training to train the other members - two people plus three trainers taught group only for two days - ten people went to another village to receive training on stove usage, in order to train others - not all people understood everything - new group members, as well as customers did not receive training, - new members came after most stoves were build - received training was good, but people would like to learn more, such as other construction techniques - appreciate knowledge of how to build stoves with material which can be found in the environment - most members know just a part of the building process, they could not build a stove by their own
Money: 5	<ul style="list-style-type: none"> - the project advised group and the group decided to charge a construction fee of only 2000 TZS (0,80 €) of which 1800 TZS are for the group and only 200 TZS for the constructors - often two people build a stoves for a customer which is considered as much effort for little money - the small amount of money for the constructor is not paying off the effort for busy people

	<ul style="list-style-type: none"> - the small price makes stove affordable for customers - stove users have less expenditures to buy firewood (1,5 bundles instead of 3 per week) - more money for constructor would motivate member, but not good for the affordability of customers - members feel guilty because one person build most stoves and contributed the whole construction fee to the group, they would like to pay him 1000 TZS (0,4€) per stove, but group has not decided yet - some members do not take the savings because of less firewood consumption into consideration - when wet firewood is used, the stove construction is not proper or very new, the stoves sometimes need much firewood
Forest: N/A	<ul style="list-style-type: none"> - less firewood demand lowers deforestation - some group members started to plant trees on their land
Firewood: 9,5	<ul style="list-style-type: none"> - cooking with the ICS is much more efficient in terms of firewood consumption, compared to the three-stone cooking fires - If space from stove bottom to the pot is to big allot of firewood is needed for cooking
Smoke: 9,5	<ul style="list-style-type: none"> - the cook is not suffering near the stove because of less smoke and heat emission - people which stay close to the stove experience less diseases lunge and eye diseases and it is saver especially for children - Possible reasons that there is still smoke could be: <ul style="list-style-type: none"> o construction not properly o direction of chimney not being built properly o wet firewood - her stove has recently broken chimney, which cause that smoke comes inside of her house - less smoke emission at the stove cause less smut/grime, wherefore hands and cloth stay clean and less laundry need to be washed

Source: content analysis of audio recorded opinion line within group session (22.3C-7).

As indicated in Table 120 the farmers' satisfaction regarding their specific outcomes of certain outcome themes was very high for three out of six themes, which were "Time", "Firewood" and "Smoke". The group members really appreciated that they are able to cook on two plates on the stove, which make the process of cooking food much faster and also saves firewood, therefore their expectation have been met. The group members also emphasized that due to less exposure to smoke people suffer less from smoke related health effects. It was also positively embraced that people are being less affected by the heat when they need to stay close to the stove as there is no open fire, which is also perceived much safer, especially for children. It was also emphasized that the cooking process is cleaner using the stove due to less smut, wherefore hands and clothes stay clean too.

F: "When we cooked before it was very dirty, as there was much more sweat and smoke and the whole pot was black so if you forgot and use bear hand you get the black colour."

T: "But also with the stove you still have the black smut, or how do you do it?"

F: "It is not much, because it is only the bottom of the pot so the top part is clean. Before, we used to wash our cloth daily, but with this stove I can use it (cloth) for four days. So, washing has reduced."

Stove group session (22.3C-7), Ilolo; F: Female group member; T: Translator

The outcome theme that the farmers referred to most critically is “Money”, which also matches to findings already elaborated in section 3.3.2 but not the findings presented in section 0. When farmers of the group prioritized their different outcome themes, the importance of outcome theme “Money” was valued as low, as it was not prioritized by any group member. However, the medium (5) degree of satisfaction of the outcome theme “Money” indicates that farmers’ have had expectations to generate income through innovation implementation, which have only been met to a small extent. The debate within the group is on how to solve the problem that stove constructors, as well as the group benefit, is low and the price is not too high for the customers in this rural environment, shown through the following consideration:

F: “I’m at the middle (of the opinion line), because yes, we have the income, but it is very small. So, if we request 5000 (TZS as construction fee), it is not possible and 2000 (TZS) is too small. We discussed this, but did not change anything, yet. The income for the technician is too small he/she should get something, at least 1000 (TZS). Because if he/she takes the 2000 (TZS) to the group he/she will fell demoralized and lazy.”
Stove group session (22.3C-7), Ilolo; F: Female group member

The high incidence and the elaborate way in which topics assigned to the outcome theme “Money” were discussed, shows that the topic seems to be contentious for the group members. Subsequently, a summary of the satisfaction of the kitchen garden group members concerning their experienced innovation outcomes is presented in 16 as follows:

Table 16: Summary of kitchen garden group members’ reasons for degree of satisfaction regarding different outcome themes

Outcome theme: Groups’ degree of satisfaction	Reasons for farmers’ individual degree of satisfaction (Farmer is (not) satisfied, because...)
Time: 10	<ul style="list-style-type: none"> - not a big effort to prepare bag and members helped each other - cultivation method is space-saving and not soil dependent and enables the cultivation nearby the house - all cultivation measures, irrigation and harvest can be done right away, quite easy and efficient without spending time along the way - sewage water can be used to water the plants which might decrease additional water transport for irrigation purpose (, but this differs among members) - fence is needed to protect vegetables from animals and it might be an extra effort in time and energy to build a fence (,but this was not negatively mentioned by the members)
Knowledge: 10	<ul style="list-style-type: none"> - group received two days training, about filling material, bag preparation and HH nutrition training - group knows how to build a bag to harvest vegetables (, but would be nice to learn more) - some farmers want training about plant protection to treat vegetables by themselves - would like to know about alternative plant protection (some farmers agreed that it is better to use traditional pesticides (ashes) directly than to wait for officer to spray artificial pesticides, but not all members know about those remedies)
Money: 4	<ul style="list-style-type: none"> - farmers’ vegetable harvest is not enough to be able to sell it for income generation - chicken ate KG vegetables; it remains enough for own consumption but not

	<ul style="list-style-type: none"> - to sell - to less bags to harvest for distribution (, at least two – three bags are needed) - seeds were not yet available to build more bags - farmers can't effort to pay irrigation water for additional bags in dry season
DCC: 9	<ul style="list-style-type: none"> - farmers can still cultivate leafy vegetables, when it is too dry for garden - less water is needed to have vegetables, sewage (grey) water without soap can be used to irrigate, but often extra water is needed - mostly HH water is not enough, additional water for irrigation need to be fetched - high effort to get water in dry season (has to be bought and carried from often far away source) - area is very dry, sometimes even no water in deep wells, no electricity for pump, etc
Food: 10	<ul style="list-style-type: none"> - harvest enough to improve family's diet - family feels healthier and immune system seem to be stronger to fight diseases - there is additional food, but some harvested just once or twice - members which eat vegetables daily explained, that they not just rely on supply from KG - average harvest one to two times per week - increasing number of people like to consume leafy vegetables

Source: content analysis of audio recorded opinion line within group session (23.2AB-8)

As summarized in 16, the farmers' satisfaction regarding the specific outcomes of certain outcome themes was very high for three out of seven themes, which were "Time", "Knowledge" and "Food". The group members really emphasized their overall satisfaction with the additional food the members receive through implementation of their kitchen gardens, which supply their diet with fresh leafy-vegetables. The farmers also appreciated the knowledge about how to improve HH nutrition and the preparation of kitchen gardens. Additionally, the members were satisfied with the time saved concerning food preparation, through immediately available vegetables close to the house. The outcome theme that the farmers referred to most critically is "Money"; this is surprising as the group members formerly stated that the food expenses have been lowered by own vegetable consumption (Table 12), as there were no additional costs to build the kitchen garden, (because the seedlings and the bags were provided by the project). The group members were quite critical about their possibilities to generated income by the marketing of vegetable surpluses, even though the stated intentions when the innovation was introduced was mainly to improve the HH diet. This indicates that farmers' expectations were different from the intended innovation outcomes, as their expectation are not met to a big extent regarding the amount of harvested vegetables that can be sold.

F: *"I have to eat first and then I would like to sell because I cannot sell if am not satisfied and I could never sell any of those vegetables, that's why I'm not satisfied."*

Kitchen garden group session (23.2AB-8), Ilolo; F: Female group member

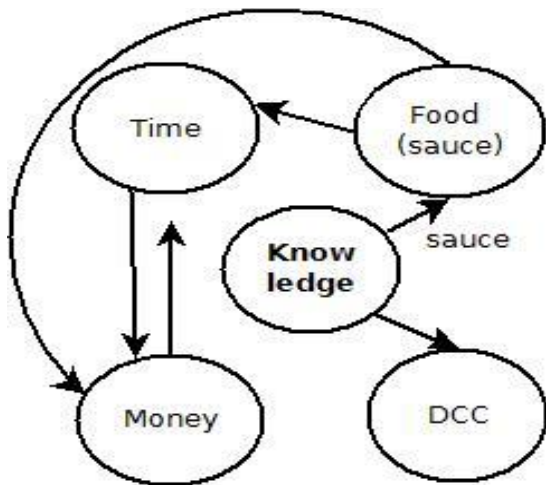
As farmers' views on their innovation outcomes have now been presented, the focus in the following section is on factors influencing those innovation outcomes.

3.4 Farmers' perception of factors influencing innovation outcomes

3.4.1 Farmers' perception of inter-connections between innovation outcomes

During the collaborative work with the farmers, especially when they were asked to select outcome themes according to their priority (outcome ranking), the farmers sometimes started to explain the inter-connections of different outcomes. Such an analysis was initially not intended in this research.

Figure 11: Depicted outcome complex of kitchen garden group member

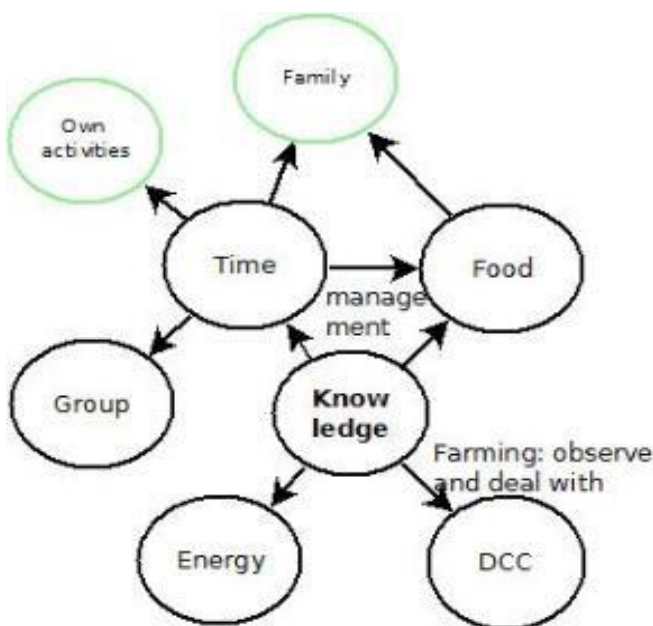


Source: Author

statements, of individual farmers from two groups are cited and depicted in this way.

For example, Figure 1 displays the following statement of a male kitchen garden group member: “For me everything is about knowledge: I have it in sauce, in time, if I have saved time I can earn money, (...)

Figure 12: Depicted outcome complex of a pump group member



Source: Author

²⁵ Green indicates indirect outcomes;

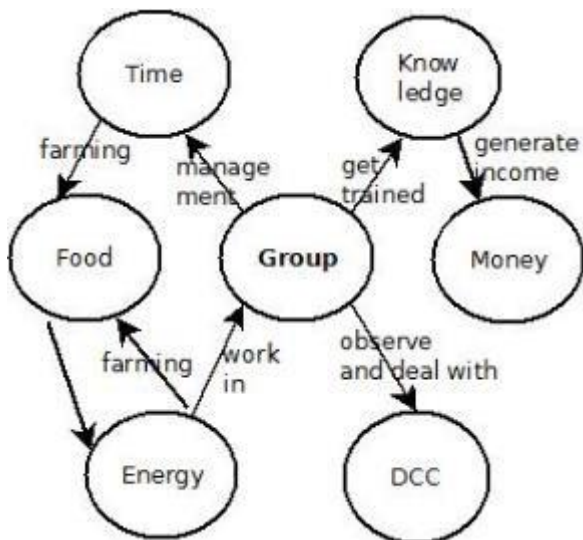
Therefore, no data collection was conducted to fully depict the innovation groups' perception about the inter-connection of their outcome themes. However, even single statements of individual farmers are valuable to give an impression of the farmers' view regarding the outcome themes' inter-dependency. In those cases, the farmers' prioritized outcome was functioning as starting point to explain the influence of the chosen outcome on other outcomes. In the Micro-dosing group, a farmer simply explained that he has “seen the basis of the other five outcomes (outcome themes) is knowledge.” Other farmers elaborated that most outcomes cannot be seen as single events; they are part of an outcome complex in which most parts influence each other. This network-like complex of certain innovation outcomes can be displayed through outcome pathway mapping. Therefore, three

(...) all these outcomes, they are the same. For example, first, second and third outcome we got because of the training we received. I get sauce and I have something to eat; with vegetables I can earn money, if I have money I save time, but I could choose one outcome only.” (Group session (23.2AB-8))²⁵

In the pump group a female farmer explained the inter-connection of the groups outcome themes, presented in Figure 2, as follows: “I choose knowledge, because I know, if I have knowledge I can manage time, so I can take care of my family. When they get food and then I can do my own activity. Second, I will still look at the time to be with my group for cooperation and also I will observe the weather condition to know when I should farm using the education I got. I think knowledge can represent everything even how to work without using much energy” (Pump group session (15.2C-5)). Another

female farmer of the pump group explained: “When I’m in a group everything will come into place. In a group we can find a trainer to educate us. Other things like time management and garden cultivation: When we farm, we will get sauce, we will get energy to continue working in the group and in the garden. We will get money from the training which I received in the group. I will observe the weather condition. So all these can be obtained in a group” (Pump group session (15.2C-5)). This quote is depicted in Figure 13.

Figure 13: Depicted outcome complex of a pump group member



Source: Author

3.4.2 Influence of restricting factors on innovation outcomes

As shown in Table 23, restriction of innovation outcomes in all six IG’s were due to four identified sources of influence within the innovation system, which namely are the innovation, external factors, the groups and the individual farmers. The IGs are situated in a strongly restricted environment. Even though the conditions in Kilosa district are less restrictive, in terms of environmental conditions compared to Chamwino district, a farmer from Changarawe (Kilosa district) expressed the restrictiveness of the livelihood conditions in her setting as follows:

F: “We are used to this hard life. When there are bad things, if you have no alternative, then you will get used to that”.

Semi-structured interview (6-SSI-3), Changarawe; F: Female Farmer of processing group

Referring to the restricting external factors, it is self-evident that these factors have a strong influence on the whole SH system; Table 23 gives specific examples of how such factors affect innovation outcomes in particular. IG members of all six group stated that their innovation outcomes were strongly restricted by extreme weather condition, which impeded more beneficial outcomes. The SHF in this area suffered due to huge harvest losses, caused by drought and floods, which happened in the last two seasons. IG members also stressed the poor infrastructure, which is restricting their market access for input as well as for output markets and, in some cases, even to simply access farmers’ fields. In the rural environment where the CSS are situated the IG members complained about the overall low economy, which makes it very difficult to find financial means to realize their projects and to generate income.

Table 23: Innovation groups' restricting factors on innovation outcomes categorized according to their source of influence within the innovation system

UPS or CL group	Innovation Is restricting innovation outcomes because,...	External factors	Innovation group	Individual Farmer
Improved Maize Processing	<ul style="list-style-type: none"> - without means of transportation it is difficult to move the sheller from one farm to another - size of machine not suitable to be pushed manually - much more customers could be reached and more income could be generated if transportation problem could be solved - not all farms can be reached, that is why transportation costs of those farmers remain - dust generation is affecting the farmers while operating the machine - manual starting and pushing of machine is physically very demanding 	<ul style="list-style-type: none"> - there was a poor maize harvest due to drought last season and floods this season - this year only one maize harvest, instead of two - maize cultivation on nutrient poor soil cause low yields 	<ul style="list-style-type: none"> - group has management disputes - the groups division in sub-groups separates strong and weak group members - members are evading the group work - low group meeting participation (at least 8 people are needed to decide) - representatives attend meetings instead of group members - responsible experts for fuel and machine maintenance are lacking - members which can start the machine are missing - starting process and machine maintenance is not done on a regular basis 	<ul style="list-style-type: none"> - physically weak members feel as burden for others - physically weak farmers are not capable to cultivate their whole available farm land manually (less harvest) - farmer don't do crop rotation, which could increase their yield - farmer have very high private work load
Bike renting business (Upendo)	<ul style="list-style-type: none"> - service and maintenance of old bikes is time and money intensive - purchasing of new bikes is wanted - business training is considered as not sufficient (training expensive, short time, trainers not well prepared) 	<ul style="list-style-type: none"> - flood destroyed group fields this season - bikes stored for already three months, because in muddy environment (through unusual heavy rain fall) bikes are easily damaged - difficult group registration, many administrative, bureaucratic issues - customers don't pay 	<ul style="list-style-type: none"> - difficulties with external person employed for bike service (fraud) - attendance to group activities and unity and support within the groups could be better - no meeting was convened for more than three month - Strife within the group (political disagreement, differences in group management issues and distribution of responsibilities) - Started as CCM youth group, but political motivation not intended 	<ul style="list-style-type: none"> - high work load of farmers - Busy farmers are involved in many other activities

		their renting fee in time (debts)	<ul style="list-style-type: none"> - trust and management of financial issues is unclear - members don't follow constitution 	
Rainwater harvesting & MD	<ul style="list-style-type: none"> - just some people had access to training (out of 150 people farmers with fields having certain preconditions were selected by trans-SEC) - rwh just small/ no influence on water household of fields when weather is extreme 	<ul style="list-style-type: none"> - drought last season caused very poor yields - floods this season destroyed some fields (Tied ridges were washed away) 	<ul style="list-style-type: none"> - unregularly group meeting were all members are invited. - decision making in the group and training for new members is problematic without regular meetings 	<ul style="list-style-type: none"> - farmers need to own suitable land
Tuamiho: Irrigation water pump	<ul style="list-style-type: none"> - seeds for other crops hard to get (crops which are not infested by T. absoluta) - little training, no training how to fight Kantangaze - selection of suitable group farm area is difficult (not to close to river, but with access to water, according length of hose) - Little income generation, infected fruits not marketable - expenditure for pump use and maintenance and transportation 	<ul style="list-style-type: none"> - flood destroyed field (after first harvest) - crops strongly affected by pest, poor harvest - Climate change - no direct market access - only Retail buyers in the village - Pump has to be kept in the house, otherwise stolen 	<ul style="list-style-type: none"> - Not all group members are supported by the group - Reduced number of group members, no new ones for 4 years, according to constitution - Not enough financial capital - Problems to organize pump transport properly - no transportation means for pump and to reach market 	<ul style="list-style-type: none"> - farmers don't record income and expenses
Improved Cooking Stoves (ICS)	<ul style="list-style-type: none"> - little benefit for constructor - complicated construction, need long time, some had to be fixed often - non optimal construction, less beneficial, stove quality - not easy to use it for some members - limited number of people received training, 	<ul style="list-style-type: none"> - wind direction (smoke is blown inside) - lack of good firewood, often not dry, long distance to fetch - customers have not enough money, overall low economy; - groups need to be registered 	<ul style="list-style-type: none"> - lack of construction skills of most members - group is dependent on work of skill-full and passionate individual farmer (not all respect his work, he is not compensated) - no construction, no group work, because of farming season - low attendance to group activities, meetings 	<ul style="list-style-type: none"> - low motivation for group work, private activities more beneficial - own stove but don't use it - not enough space for stove - focus on money - low problem

			<ul style="list-style-type: none"> - some stoves are still not finished - lack of motivation, due to less financial incentives 	<ul style="list-style-type: none"> awareness - meeting in group and speaking in public is new
HH nutrition education & Kitchen garden training	<ul style="list-style-type: none"> - low durability of the bags (low UV-light resistance) - no seeds for new vegetables available (seed propagation not yet done by the farmers) - KG was intended for improvement of individual HH nutrition, but farmers want it for income generation - fences needed to protect KG from feeding animals (time and resources) 	<ul style="list-style-type: none"> - water scarcity (effort to fetch water and expenditure, sewage water not enough) - no market in the village - pests and feeding animals - high inflation, price fluctuation - “don’t you have work to do?” stated by neighbours when innovation was implemented 	<ul style="list-style-type: none"> - only secretary received comprehensive training - responsibilities - lack of knowledge for proper plant protection 	<ul style="list-style-type: none"> - no money to maintain the bag in dry season - limited apprehension (esp. old people) of short training - low problem awareness

Source: Content analysis of audio recorded and transcribed group sessions and especially “Missing link” during feedback session (29.FB.1; 30.FB-2; 31.FB-3

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Even though IG members were referring to restricting factors during group sessions and interviews, a trend was noticed of farmers blaming their group leaders for being the source of unwanted group dynamics that restrain positive innovation outcomes. When arguments of members and leaders were opposed, the notion arose that some farmers do not fully express their personal possibilities and responsibilities in order to shape their own innovation process. Therefore, the introduction of a participatory tool during the feedback session revealed some more insights into group dynamics and the suitability of the innovation in the situated environment. This tool called “Missing link”, as described in section 2.6.4, was conducted to reflect on which adaptations in the innovation system are needed, in order to learn about and contemplate farmers’ action possibilities/ room of manoeuvre to improve the progress of their innovation implementation.

Regarding all six IGs, it can be generally said that it was a problem to hold meetings on a regular basis, with enough group members to be quorate and therefore, to be able to decide for the group. The farmers’ scarce time, because of the overall high workload, the coverage of long distances without means of transportation, in sometimes harsh weather conditions, and the farmers’ overall poor economic situation often cause the farmers not to attend their group meetings.

M: *“Yes, meetings are important.”*

T: *“Now we are asking, why didn’t you go to the leaders and tell that you need one (meeting)?”*

M: *“Because, it was the farming season, so we did not have that time.”*

Feedback session (31.FB-3), Ilakala; T: Translator , M: Male member of the micro dosing group

M: *“sometimes it rains heavily and people are living far away, than they need to cover the distance, running through the rain, so it’s not easy to attend the meeting.”*

Feedback session (30.FB-2), Changarawe; M: Male member of Processing group

F: *“You have to remember, most group members here do not have wages and some wake up and think they don’t have food to eat and hence, go out and look to find work. You can’t ask them to come back to the meeting. From January up to April, meeting was a problem but we were meeting.”*

Bike group session (7.1C-4), Changarawe; F: Female group member

All UPS groups experienced that a high share of members do not attend regular group meetings without financial compensation. Due to the fact that farmers in those four groups, are financially compensated (3000 TZS (1,25 €) per session) for their attendance in meetings convened and conducted by the project, some group members’ motivation for their attendance of regular (uncompensated) meetings, which are convened by the group leaders seem to be low.

M: *“In our group people are difficult, because even during dry season²⁶, if you call in for the meeting people will not attend. Maybe, if we have visitors, they know: If we go there we get something”*

Interview (26.SSI-18), Ilolo; M: Male member stove group

T: *“Have you ever called for a meeting and ask them why they didn’t come, because there are no allowances?”*

F: *“Yes, I don’t get the respect of the group members, when I call for a meeting, they refuse and ask, if you are going to give them allowances. Leaders call for meetings and find themselves seated there alone.”*

Feedback session (29.FB-1), Ilolo; T: Translator, F: Female member (Secretary) of Stove group,

²⁶ Farmers tend to have more time in the dry season.



Trans-SEC

Innovating pro-poor Strategies to safeguard Food Security using Technology and Knowledge Transfer

T: *“Do people don’t come (to attend group meetings), because they are not paid, is that true?”*

F: *“Yes”*

Feedback session (31.FB-3), Ilakala; T: Translator , M: Male member of the micro dosing group Ilakala

Also, trainings conducted by external trainers are valued much higher by the farmers than knowledge which can be disseminated by the farmers.

M: *“there is not much strength when one of our own is teaching, the other members don’t give it weight. They will say: “We know him, he just knew it recently, how can he teach us?” So they give it more weight when someone from outside come to teach them.”*

Feedback session (31.FB-3), Ilakala; M: Male member of the micro dosing group

Those examples express some of the restrictions the farmers face, due to difficult group dynamics and individuals’ restrictiveness.

What is remarkable is that farmers did not consider the support they could receive in every CSS by the local AEO, which is the farmers direct contact persons for the project, if they define their problems and directly ask for help. For example, the request for appreciated additional training appeared to be difficult to communicate by the groups, as well as the specific content of the wanted training, or the issue the farmers would like to learn about, sometimes remained unclear.

T: *“have you ever talked to the agricultural officers, like Samuel, that you need training?. You have never told him?”*

F: *“We have not talked to him as a group. He just comes after a meeting and that is it.”*

T: *“So you have never told him that you need to learn about one or two things?”*

M: *“No.”*

F: *“Not yet.”*

Feedback session (31.FB-3), Ilakala; T: Translator, Male (M) and Female (F) member of water pump group

A IG member of kitchen garden group stated that he noticed that some people in the group do not follow up what they have learned, observe the environment and think about solutions.

M: *“Education in the sense that you have been trained, but you don’t want to add on yourself and say who trained should continue that is also a challenge. Yes that what you learn you don’t think how you will benefit with the training(..) I mean short minds as written. I have planted my vegetables sometime the plant produce a small leaf, so I will have to think why the plant have a thin leaf, which formula should I use to get a big leaf do I need to add fertilizer?”*

T: *“What do you say is it a challenge small minds (...) what do other say, is that a challenge?”*

F: *“That is a challenge (..) small minds people don’t follow to see the growth, wherefore they can’t contribute to find solutions.”*

Feedback session (29.FB-1), Ilolo; M: Male member from kitchen garden group and F: Female member from stove group

Additionally, people seem to have problems with the organizational structure that was brought to them, which was stressed by another IG member:

M: *“And this project I think has many years someone to be used in speaking in public so if we want to explain to many people, it will be a problem, because we’re not used to speak in public. And this project, there are people used to speak in public, so they know examples and criteria but this is something very new for us. Meeting in a group is something new, people are not used to sit and plan what we are going to do, that is difficult. People will improve, it is coming regular, day after day. Out of regularity people will get used.”*



Feedback session (29.FB-1), Ilolo; M: Male member from kitchen garden group

Another general problem was revealed in the feedback session, which was stated by a female farmer as follows:

F: *“What we answered, we tried to answer correctly. People didn’t understand, that is why they answered according to what they learned in the trainings. They thought: If I answer related to the training, I’m making it more successful, but we are supposed to say the exact situation we are in, so that we find a solution. Now, there is help, and we should answer her questions correctly, because we know the exact situation. (..) It is true we have the answers from the teachings, if I answer this way I will make it successful, but there is lie.”*

Feedback session (29.FB-1), Ilolo; F: Female member from KG and stove group

Farmers tend to have a very positive attitude towards the project, as they appreciated the attention given to them, expressed through the following quote:

M: *“I did not have the same scope, but those changes comes as outcome I saw after the project started, now we thank the Trans-SEC project for help us to save the time, to be able to thresh easily and get benefits.”*

Processing group meeting (1.1A-1), Changarawe; M: Male group member

However, the relation of the project members and the farmers seem to be not on a level playing field, due to limited integration of the farmers in research activities, as indicated by the following quote:

F: *“Just the other day, there was someone, she taught us and interviewed, and then we didn’t ask where are you taking the answers, we just gave the answers without questioning, where is she taking the interview, because we are happy.”*

Kitchen garden group session (23.2AB-8), Ilolo; F: Female group member

The innovations with their intended results, as well as the structure of how to implement them, were brought to the farmers from outside. The problems, which may be due to such an approach are expressed to a quote of the report about the conducted UPS group formation in which was stated that, the “majority of the farmers have poor understanding of the project with its expected results.” (MVIWATA, 2016, p. 3)

The innovations were selected to be “pro poor”, but the pre-defined group criteria already indicate that especially poor people may be excluded even before innovation implementation, as they could not fulfil those criteria.

Additional constraints of IG members within the innovation process, due to socio-cultural factors of age and gender, are presented in the following section.



3.5 Influence of individual farmers' age and gender on innovation outcomes

The experienced innovation outcomes of the IG were not the same for all individuals of a certain IG. The Table 23 provides an overview of perceived differences or experiences made by IG members due to their age.

Table 23: Age considerations within the groups

UPS or CL group	Age (Age is an issue, because...)
Improved Maize Processing	<ul style="list-style-type: none"> - it not possible to start and push machine for elder people - machine should make maize processing less physically demanding, but pushing and starting of it can only be done by physically strong people - before implementation maize shelling was a job for young people, children and women (men would not have done it), which means less burden for young people and old women when the processing is done mechanically - it was stated that the youth like helping to work with the machine
Bike rental business (Upendo)	<ul style="list-style-type: none"> - the group initially started as youth group for young, but open for everyone today - young people want quick financial benefit, some seem not to be patient to slowly build up group work
Rainwater harvesting & Fertiliser micro-dosing	<ul style="list-style-type: none"> - manually cultivated field size of elder people often not so big, due to lower physical ability, which cause less potential harvest - older people tend to farm always at the same plot, low physical ability to make new farm land accessible - attendance to group meetings for elder people not so easy, if long distance need to be covered without means of transportation
Tuamiho: Irrigation pump (Tuamiho)	<ul style="list-style-type: none"> - all group members are respected equally in the group - the oldest member is the groups chairperson who is unburdened from carrying the pump, but considered as very active - an old and tired member, want new input from experts
Kitchen Garden	<ul style="list-style-type: none"> - apprehension of old people is not so good, they need to get additional training to grasp the knowledge (received training was considered as short)

Source: Content analysis of all interviews and group sessions feedback sessions; (no findings for stove group)

As shown in Table 23 there were findings concerning the age of group members in five of the six IGs. Mostly, those findings relate to restricted physical or mental ability of elder people, but there are also findings that refer to young people's impatience within the innovation process if they do not perceive immediate benefit as stated in this quote:

F: "Young people, they want to benefit so quick they want just to have money."
Interview (11.SSI-7); Changarawe; F: Middle aged female from bike group

In the processing group it was stated that young people and women are unburdened from their hard task of threshing maize manually, which was only conducted by them, since the group owns the maize sheller. Now the task of maize processing by operating the maize sheller shifted to be men's



duty, as the operation process is physically very demanding, practically excluding members from that work which are not able to fulfil the task.

M: *“We usually push and operate the machine with around 7 people and now since were many there is a tendency of evading responsibilities. All group members usually have a three days shift to operate the machine, but it may happen, that during the days that I’m supposed to work there, I may be busy with other activities. Most of the time people evade the job (to push and operate the machine), as you know it is a really tough job. Because if there is a threshing job here, you have to take the machine from there and bring it here. So mostly people evade that, and there is no big income earned per day. The income is just small. (...) As you know there is no much work (bad yields due to drought last season), you might go somewhere, you just thresh 10 sacks so you may receive only 1200 TZS (0,50€) each.”*

Semi-structured interview (5.SSI-2), Changarawe; M: Male farmer of processing group

F: *“But what we cry out for is the push process, it is so hard that without men can't be done, nor even to start it (the maize sheller). That is why we wish something could be done to simplify, that even women could operate when there are no men.”*

Semi-structured interview (6-SSI-3), Changarawe; F: Female farmer of processing group

As only the ones who operate the machine have the possibility to generate income for themselves, women and old people seem to be excluded from those financial benefits. An old lady from the processing group describes her circumstances as follows:

F: *“Each time am thinking, we are four women (in the group), we can't help much with the machine, it's like we all the time benefit from their (men) hard work, this is why I decided to use my son to support them as he is also a young man. And whatever he earns we share, yes, whatever we get we share equally, but that is not my aim to benefit out of other hard work. At least, he can be helpful, rather than me in, is just like a burden to them, I can only help when they have already brought the machine to the field by taking threshed maize to the machine outlet, and put aside, then it feels like I don't do anything.”*

Interview (6.SSI-3), Changarawe; F: old female member of processing group

This quotes already indicate that age and gender considerations often inclusive of both aspects and it would not be meaningful to split them, as shown in the example above. Therefore, the perceived differences or experiences made by IG members due to their gender are included in Table 4.

Table 24: Gender considerations within the groups

UPS or CL group	Gender (Gender is no/an issue, because...)
Improved Maize Processing (n= 16, F:4; M: 12)	<ul style="list-style-type: none"> - harvesting maize cobs is task for everyone (M, F, children) - maize shelling used to be a very physical demanding work for women (and children) - mechanical processing reduces work load of women <ul style="list-style-type: none"> o better for their health / physical constitution o time for other activities o Women feel more respected - dust is affecting everyone working near the machine - pushing and starting machine is men job <ul style="list-style-type: none"> o considered as too hard for women (, old lady sent her son) - income generating employment for men - machine shall improve lives of men and women, both are now involved in the shelling process - burden of women reduced, but financial benefit earned by men (for the family) - group has already done gender sensitive exercises
Bike rental business (Upendo)	<ul style="list-style-type: none"> - small income, generated through group work, already improve



Trans-SEC

Innovating pro-poor Strategies to safeguard Food Security using Technology and Knowledge Transfer

(n= 20; F: 10, M:10)	women's life - two of three group leaders are women
Rainwater harvesting & Fertiliser micro-dosing (n= 40; F: 12, M: 28)	- most women in the session were representatives - women seem to be not equally considered to receive training - field size as big as physical ability - working hard will bring benefits no gender differences - innovation suitable for people which can't leave their home <ul style="list-style-type: none"> o Women are mostly doing care work (children, elder people) at home o no possibility to be active in the group, attend group meetings
Irrigation pump (Tuamiho) (n= 12; F: 5, M: 7)	- knowledge is considered as very important for both gender - group was valued especially by women - time saving irrigation process, offers time for both men and women, but for the latter was stated that they have now, 2por time to take care for children, domestic work and own activities
Improved Cooking Stoves (n= 25; F: 12, F:13)	- women tend to be more active in group meetings (attendance) - men and women in group, but men tend to construct stoves - women mostly responsible for food preparation, stove users - benefits bachelor men as well who cook for themselves
HH nutrition education & Kitchen garden training (n= 27; F: 17, M:10)	- after husband was convinced he supports his wife with KG and want to eat the vegetables - domestic work, HH nutrition, and care work, women domain, so as KG bags near doorstep - women tend to be more active in group meetings (attendance)

Source: Content analysis of all interviews and group sessions feedback sessions; n: number of group members, F: number of female group members, M: number of male group members

As shown in Table 24, there were findings concerning the gender of group members in all six IGs. In general terms it can be stated that the three innovations implemented at HH levels seem to benefit especially women, as many of them are still mainly responsible for domestic and care work. The outcomes of innovations implemented at the group level tend to be more similar for both gender, with the exception of the maize processing as already elaborated above. Even though there is this discrepancy, a woman from the processing group stated:

F: "May be I should tell you this: according to the life I used to live, someone as poor as me, I have seen machines belonging to others. I have never imagined one day the machine will be under my empire (under my control). God can make a way of giving u something you were dreaming of but you couldn't afford to have it."

Processing group session (3.1B-3), Changarawe; F: Female group member

For a full discussion of these results, please consult:

MIEVES, E. 2016. "Farmers' views on innovation outcomes: participatory outcome evaluation with smallholder farmer groups in Tanzania." Master thesis in Sustainable International Agriculture, Faculty of Agricultural Sciences, Georg-August-University of Göttingen and Faculty of Organic Agriculture, University of Kassel, accomplished at DITSL.



4 CONCLUSIONS AND RECOMMENDATIONS

Within the frame of Trans-SEC, which focusses on improving household food security of SHF in Tanzania by promoting innovations, the objectives of this research were to identify farmers' views on their actual experienced innovation outcomes, as well as their views on the factors influencing these outcomes, and to relate these to the project's intended innovation outcomes. For that reason, multiple participatory outcome evaluation tools were applied to learn about farmers' perceptions, in order to understand individuals' expectations, valuations and satisfaction regarding their outcomes and to gain insight into what and how different factors, from the farmers' perspective, have influenced these outcomes. Six innovation groups were involved, located at three different CSS, with each group implementing a different innovation.

Farmers categorized their various individual innovation outcomes into outcome themes, of which outcomes assigned to "Time", "Money" and "Knowledge" were important for most of the groups. It was shown that outcomes from all three themes comprise benefits such as time saving, financial advantage and knowledge generation, as well as restrictions due to time spending, financial disadvantage and lack of knowledge (that is needed for successful implementation), due to the innovation implementation and processes. To compare intended outcomes with farmers' experienced innovation outcomes, these were transferred into outcome domains, which are based on farmers' dimensions of well-being, in order to consider the influence of outcomes on farmers' lives. It is shown that the three outcome domains "Physical", "Financial" and "Intellectual" covered most of the intended as well as the experienced outcomes of the six innovation groups. Outcomes that have influence on farmers' "Social" well-being were only intended by two groups and were stated to be actually experienced by three groups. Outcomes that were assigned to the "Environmental" domain were intended by two groups and experienced by four groups.

The average "degree of satisfaction" (DOS), across all outcomes²⁷, was rather high at over 8/10.²⁸ This seems inflated when one takes into account farmers' explanations, statements and reasons for why their expectations regarding their innovation outcomes have (not) been met. Reflecting on the outcome themes that were most important for the majority of the six IGs ("Time", "Knowledge", "Money"), the groups' average DOS were 9,9, 8,3 and 3,5 respectively. When these figures are considered alongside with the valuation of the outcome domains, it is shown that innovation outcomes regarding farmers' time, assigned to the "Physical" domain, were perceived as very beneficial, but appeared to be of less importance (as these were prioritized only by a sixth of the farmers). However, gaining knowledge was the most *prioritized* innovation outcome of nearly half the participating farmers. They also seem to be quite satisfied with the knowledge they have already gained during the innovation process. Concerning outcomes assigned to the "Financial" domain, which was prioritized by a fifth of the participants, farmers were in general unsatisfied with the financial benefits gained through the innovation implementation.

Farmers also explained perceived inter-connections between their experienced innovation outcomes, which clearly indicates that it is not the single outcome that makes the difference in farmers' lives. Moreover, one outcome may start a cascading process of beneficial or even restrictive outcome interdependencies, which influence farmers' livelihoods/well-being. In order to gain deeper insights in such complex outcome inter-relations of innovation systems, integrated approaches may be applied for further investigation.

A vast number of restricting factors for successful innovation implementation were identified, which can be associated to four sources of influence; namely, the innovation itself, external factors, the

²⁷ Only four groups, namely pump, micro-dosing, stove and kitchen garden group, (per)formed the opinion line

²⁸ On a scale from 1 (not satisfied at all) to 10 (fully satisfied)



Trans-SEC

Innovating pro-poor Strategies to safeguard Food Security using Technology and Knowledge Transfer

innovation group and the individual farmer. Individual farmers' room for maneuver to influence such restrictive factors remains low. For example, important restrictive external factors, like extreme climatic conditions, could not be influenced. Also, farmers' influence on the innovation process might be neglected (for the project UPS groups), because they could only choose an innovation that was already designed by scientists. Most of the innovation groups were very restricted in terms of financial capital to adapt their innovation effectively (excluding the ICS group), to improve the innovation process. Group dynamics and performance may be influenced by the individual farmers, but group management remains a major challenge to the innovation process; on that account, farmers requested support.

Which and how innovation outcomes are experienced by the individual farmer is mainly dependent on their capital assets and socio-cultural background: what farmers experience is dependent on who they are. For example, in one IG the task of maize processing shifted to become a male duty, as the operation of the introduced machine is physically very demanding, practically excluding certain members (predominantly female and elderly) from that task. On the other hand, only certain farmers could benefit from access to the machine, based substantially on their wealth status and location of their fields. Therefore, it is emphasized that the above results need to be contextualized to the real world situations from which they originated, by giving consideration to the details that are revealed by this qualitative approach. However, trade-offs are recognized between the quantity of groups included in the research and the depth to which results can be elaborated.

The applied POE tools supported farmers to express and formulate their needs and offered a platform to expose them. This participatory outcome assessment offers findings that can be used to adapt, improve and make innovation processes more effective, providing a learning loop, (if the knowledge is reintegrated), that feeds information back into programs. Within Trans-SEC, the HH survey and IG-specific monitoring surveys can be fruitfully used to triangulate the findings of this study.

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6 ANNEXES

Annex 1: Summary of transcribed audios

No. of activity	code	Date	Group	min transcribed
1	1A-1	02.02.2016	UPS 3	81
3	1B-3	04.02.2016	UPS 3	62
4	SSI-1	06.02.2016	UPS 3	31
5	SSI-2	06.02.2016	UPS 3	59
6	SSI-3	06.02.2016	UPS 3	48
7	1C-4	08.02.2016	Upendo	101
11	SSI-7	10.02.2016	Upendo	73
12	SSI-8	11.02.2016	Upendo	72
14	SSI-10	12.02.2016	Upendo	48
15	2C-5	15.02.2016	Tuamiho	124
16	1AB-6	16.02.2016	UPS 1	171
17	SSI-11	17.02.2016	UPS 1	77
18	SSI-12	18.02.2016	Tuamiho	58
19	SSI-13	18.02.2016	UPS 1	11
20	SSI-14	18.02.2016	UPS 1	60
21	SSI-15	19.02.2016	Tuamiho	64
22	3C-7	22.02.2016	UPS 5	163
23	2AB-8	23.02.2016	UPS 10	182
24	SSI-16	24.02.2016	UPS 5	50
25	SSI-17	24.02.2016	UPS 5	55
26	SSI-18	24.02.2016	UPS 5	61
27	SSI-19	25.02.2016	UPS 10	28
28	SSI-20	25.02.2016	UPS 10	42
29	Fb-1	06.03.2016	UPS 5+10	57
30	Fb-2	08.03.2016	UPS 3+Upendo	40
31	FB-3	08.03.2016	UPS 1+ Tuamiho	47
Total in min				1867
Total in h				31

Code: activity (e.g. group session (GS) (consecutive no. of variation: A, B, C, AB); FB=Feedback session; SSI=Semi-structured interview; consecutive numbering of specific activity (e.g. GS, FB, SSI)

Annex 2: Group session: variation A

<p>Main purpose of the session: What are you trying to achieve? To get an understanding of the group members' perspective of important innovation outcomes</p> <p>a) To understand the different reasons, why outcomes are considered as important (labour, income, fun) among the group members</p> <p>b) To get to know the previous expectations regarding innovation outcomes, and to which extend those were fulfilled.</p>		
<p>What is going to be observed, monitored and documented as you go?</p> <ul style="list-style-type: none"> - Audio file of the whole session - Picture of drawings of outcomes - Notes and picture of opinion line - field observations 		
<p>Who will you involve, and why?</p> <ul style="list-style-type: none"> - All members of the group to obtain the full range of opinions within the group 		
Themes	Tools	Methods
<ul style="list-style-type: none"> - Introduction of me and my objectives - Consent (Audio, time duration, photos) - Short presentation of the participants - Presentation of the meeting purpose, content and schedule 	All participants sit in a circle	
<p>Ask participants to remember the time when they have met as a group for the first time: What changes have they expected, the innovation will bring them?</p> <p>Get to know previous expectations and reasons for participation</p>		Brainstorming
<p>Ask participants for the present situation, what kinds of outcomes they have realized (How do you explain a friend which changes the innovation brought to you?)</p> <p>If just "technical" outcomes are mentioned, share own experience (new friends, learned sth, leadership skills, etc)</p> <p>Get to know outcomes and reasons why those are considered as important for participants</p>	depict outcome themes on cards	Paired interviews
Short break		
<p>Show the cards that depict what you have identified as main outcomes in order to confirm your findings within the group (something to add?)</p> <p>For each outcome: Ask to whom this outcome is relevant. (Who has experienced such an outcome (by oneself)?)</p> <p>Concerned people stand up, build opinion line for each outcome whether the actual outcome has met the expectations or not. Ask for explanation</p>	draw opinion line; use depicted outcome theme cards (count! sex, age?)-> take a picture (cross explanation!)	Opinion line (line on the ground: one site expectations met/other site not met at all (happy/unhappy)
<p>Coming to the end</p> <p>How do you feel about the innovation and the already achieved outcomes (Has one something to add?)</p>		Feedback round
Selection of six people and confirmation of interview appointment		

Annex 3: Group session: variation B

<p>Main purpose of the session: What are you trying to achieve?</p> <p>1- To identify the study group members' most important innovation outcomes.</p>

<ul style="list-style-type: none"> - To understand the individual reasons, why outcomes are considered as important (labour, income, fun) 2- To understand in which way (why and how) socio-cultural factors are influencing innovation processes and outcomes? (Advantages, constraints, internal, external factors?) - To find out which key socio-cultural factors have considerable impact on the innovation processes and outcomes. - To identify how different social groups experience their outcomes differently (not yet fully addressed) 		
What is going to be observed, monitored and documented as you go? <ul style="list-style-type: none"> - Audio file of MSC an FC discussion - drawings of outcomes - field observations 		
Who will you involve, and why? Six selected group participants according to their socio-cultural background in order to include socio-cultural heterogeneity within the study group.		
Themes	Tools	Methods
<ul style="list-style-type: none"> - Presentation of the meeting purpose the content and schedule - Consent (Audio, time duration, topic, photos) - Introduction round of all participants 	All participants sit in a circle	(maybe “check in”; Befindlichkeitsrunde)
a) Participants shall do paired interviews to explain each other their “stories of change” Two rounds are conducted: HH level b) Stories are shared among the study group; development of stories by “owners” or through questions Different outcomes and individual reasons, why outcomes are considered as important	depict outcome themes on cards (bring symbol items)	MSC
Short break		
(Ranking and) discussion about which outcome is important for whom and why (-> every participant gets 4 stickers in different colours in order to decide which outcome is important for different social groups (e.g. women, men, old, young)) Collaborative selection of the MSC story for each round Information on which key socio-cultural factors have considerable impact; why and how socio-cultural factors are influencing	Ranking done with stickers on depicted outcome theme cards;	Focus group discussion (with cross explanation)
Coming to the end (How do you feel about sharing your story?) (Has one something to add?)		Feedback round
Remind on confirmation of interview appointment		

Annex 4: Group session: variation C

Main purpose of the session: What are you trying to achieve? To get an understanding of the group members’ perspective of important innovation outcomes. <ul style="list-style-type: none"> c) To understand the different reasons, why outcomes are considered as important (labour, income, fun) among the group members d) To get to know the previous expectations regarding innovation outcomes, and to which extend those were fulfilled.

What is going to be observed, monitored and documented as you go?		
<ul style="list-style-type: none"> - Audio file of the whole session - Picture of drawings of outcomes - Notes and picture of opinion line - field observations 		
Who will you involve, and why?		
<ul style="list-style-type: none"> - All members of the group to obtain the full range of opinions within the group 		
Themes	Tools	Methods
<ul style="list-style-type: none"> - Introduction of me and my objectives - Consent (Audio, time duration, photos) - Short presentation of the participants - Presentation of the meeting purpose, content and schedule 	All participants sit in a circle	
<p>Ask participants to remember the time when they have met as a group for the first time: What changes have they expected, the innovation will bring them?</p> <p>Get to know previous expectations and reasons for participation</p>		Brain-storming
<p>Present the preliminary findings of Pramila and discuss them. Ask participants for the present situation, did they experience other outcomes</p> <p>If just "technical" outcomes are mentioned, share own experience (new friends, learned sth., leadership skills, etc.)</p> <p>Get to know outcomes and reasons why those are considered as important for participants</p>	depict outcomes themes on cards	
Short break		
<p>Show the cards that depict what is confirmed as outcomes (something to add?)</p> <p>For each outcome: Ask to whom this outcome is relevant. (Who has experienced such an outcome (by oneself?))</p> <p>Concerned people stand up, build opinion line for each outcome whether the actual outcome has met the expectations or not. Ask for explanation; (count! sex, age?)-> take a picture (cross explanation!)</p>	draw opinion line, use depicted outcome theme cards	Opinion line (line on the ground: one site expectations met/other site not met at all (happy/unhappy))
<p>(Ranking and) discussion about which outcome is important for whom and why (-> every participant gets 4 stickers in different colours in order to decide which outcome is important for different social groups (e.g. women, men, old, young))</p> <p>Information on which key socio-cultural factors have considerable impact; (why and how) socio-cultural factors are influencing</p>	Ranking done with stickers on outcome theme cards	Focus group discussion (with cross explanation)
<p>Coming to the end</p> <p>How do you feel about the innovation and the already achieved outcomes (Has one something to add?)</p>		Feedback round
Selection of six people to confirm interview appointment		

Annex 5: Group session: variation AB

<p>Main purpose of the session: What are you trying to achieve?</p> <p>To get an understanding of the group members' perspective of important innovation outcomes.</p> <ul style="list-style-type: none"> 3- To get to know the previous expectations regarding innovation outcomes, and to which extend those were fulfilled. 4- To understand the different reasons, why outcomes are considered as important (labour, income, fun) among the group members and to identify the study group members most important innovation outcomes.
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<p>5- To understand in which way (why and how) socio-cultural factors are influencing innovation processes and outcomes? (Advantages, constraints, internal, external factors?)</p> <p>6- To find out which key socio-cultural factors have considerable impact on the innovation process and outcomes.</p> <p>7- To identify how different social groups experience their outcomes differently (not yet fully addressed)</p>		
<p>What is going to be observed, monitored and documented as you go?</p> <ul style="list-style-type: none"> - Audio file of the whole session - Picture of drawings of outcomes and sticker ranking - Notes and picture of opinion line - field observations 		
<p>Who will you involve, and why?</p> <ul style="list-style-type: none"> - 10 members of the group (selected for heterogeneity of their socio-cultural background) to obtain the full range of opinions within the group 		
Themes	Tools	Methods
<ul style="list-style-type: none"> - Introduction of me and my objectives - Consent (Audio, time duration, photos) - Short presentation of the participants - Presentation of the meeting purpose, content and schedule 	All participants sit in a circle	
<p>Ask participants to remember the time when they have met as a group for the first time: What changes have they expected, the innovation will bring them?</p> <p>Get to know previous expectations and reasons for participation</p>		Brainstorming
<p>a) Participants shall do paired interviews to explain each other their “stories of change” on the HH level</p> <p>b) Stories are shared among the group; development of stories by “owners” or through questions</p> <p>c) Collaborative selection of the MSC story Different outcomes and individual reasons, why outcomes are considered as important</p>	Try to depict outcome themes on cards	MSC workshop, Group discussion
<p>Show the cards that depict what you have identified as main outcomes in order to confirm your findings within the group (something to add?) For each outcome: Ask to whom this outcome is relevant. (Who has experienced such an outcome (by oneself?) Concerned people stand up, build opinion line for each outcome whether the actual outcome has met the expectations or not. Ask for explanation</p>	Depicted outcomes; draw line (gender, age?)-> take a picture	Opinion line, individual statements (include cross explanations)
<p>(Ranking and) discussion about which outcome is important for whom and why (-> every Participant get 2 Stickers in different colours in order to decide which outcome is important for different social groups (e.g. women, men, old, young)) Information on which key socio-cultural factors have considerable impact; (why and how) socio-cultural factors are influencing</p>	Ranking done with stickers on outcome theme cards	Outcome ranking
Coming to the end		Feedback round

How do you feel about the innovation and the already achieved outcomes (Has one something to add?)		
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Annex 6: Semi-structured interview guide

Introduction

Explain purpose and ask consent to audio-record.

Start with introducing myself (gender, age, family status, nb of children, occupation, practical experience)

Decrease barriers, raise confidence, give information that I want to receive as well

1. Would you like to introduce yourself?

Easy to answer for the participants, decrease barriers, short overview of socio-cultural background

PERSONAL PERCEPTION OF THE INNOVATION OUTCOME

2. How do you integrate/implement the innovation in your daily live/ in your farm? What are you doing differently than before? Can you give me an example, please? (Question depends on innovation type!)

To which extend the innovation is practically implemented? Are they really using/doing it?

3. Why have you chosen this innovation and not another one? Please, can you explain/tell me?

(Be careful, it was not a totally free choice. See UPS group criteria!)

Reasons why this group is suitable for the member, information on relevance system and maybe insights of the member's (and HH's) external circumstances.

4. What were your expectations? (What were/are you hoping to achieve?) Please can you tell me more about it? Reflection of personal view on possible or desired innovation outcomes

5. a) In how far are your expectations met? Please, tell me.

Explanation of personal expectations that were fulfilled.

b) In how far are your expectations not met?

c) Did you face any negative effects or disappointment? (or biggest lesson learnt) Can you please tell me about the time when this happened?

Comparison of personal expectations and actual situation/outcome.

6. a) If you were explaining to friends about "name of innovation" What would you tell him or her?

Personal statement about which aspects of the innovation are considered as important for peers (and therefore maybe for oneself as well).

b) Would you recommend "name of innovation" to your friends? Please, explain.

(even, if they wouldn't recommend it, ask for explanation) Personal view of possible advantages and disadvantages of being member/applying the innovation for a peer (and therefore maybe for oneself as well).

7. a) What do you think, who benefits most from applying “name of innovation”?

Influence of socio-cultural factors on innovation outcomes Imagine all the different people in your group, men and female with different education, age and health.

Score	3 (3 smiley)	2 (smiley)	1 (smiley)	0
female				
male				
Young				
Experienced				
Healthy				
Educated				
Rich				

(To make it handy for the participants, I draw a big table with smileys to score from 3-0 (benefiting a lot – no benefit at all))

b) Why do you think it is like this? (Specify the extremes!) Can you please tell me more about it?

Reasons for influence of socio-cultural factors on innovation outcomes.

8. Have you ever thought you could benefit more from “name of innovation” if you were someone else? How would you like to be? What should be different?/ For you to benefit more from “name of innovation” what would need to be different? Please explain I’m interested in your thoughts.

Constraints that the person is facing due to one’s individual characteristics and/or socio-cultural background

9. Did you experience a nice surprise, (something that you haven’t thought of) since you’re member of the group/using “name of innovation”? (or something similar) Would you like to share this moment with me?

Recalling positive memory at the end of the interview to finish in a smooth way and to leave the person with a good feeling

Any other feelings and thought about your experience that you would like to add?

Annex 7: Feedback session outline

CSS feedback sessions, suggested outline (approx. 3 hours):

1. Introduction: purpose of today's feedback session

- Activities conducted in the last 5 weeks! (e.g. research activities in each village)
- Explain about the 4 villages (use your map!);
- Give a brief intro to the different groups and their innovation project (8 different activities).
- Present how the 8 different groups explained their innovation outcomes.

2. Discuss and clarify problems I faced more or less in each group and questions to be answered:

Specific in each meeting

3. Focus on individual groups attending the session and do exercise (problem-tree):

Introduction: Present outcomes of groups again (with outcome theme cards)

- Those outcomes sound very nice, but explain that you have the impression that many group members do not benefit as much as they could.
- I think often the expectations of group members are not met. The outcomes by now still do not bring very important changes for many members.
 - a) Ask farmers to think about what is missing, what has to change that they personally would be fully satisfied with the outcomes.
 - b) What could you personally do to solve problems affecting the group in order to get good results (important changes) for everyone in the group? (What can you personally do to change something?)

Work together in your groups: 30min give paper and pens to do missing link attached to outcome theme cards. Discuss in the group, but every individual opinion is worth to be shown. (It is important that if you have another opinion than your neighbour, please state it! I want to know your personal perception, your individual experience)

- c) Each group explains their findings afterwards the other group is allowed to ask questions (30 min)
- d) What hinders you to do it? (Interest?, priority?) Do consider different "rooms of manoeuvre" for individual people with their different socio-cultural background)

4. If you could start from the beginning on, to choose another group with the knowledge you have today. What would you do the same and what differently next time? Please explain!

5. See if you could answer all the open questions within the session. If not think about how to do, but short!

6. Coming to an end.

- How do you feel?
- Questions?
- Message to other groups or to the project?
- How can I improve? Do they have an advice for me?
- Giving pictures from previous sessions; thank for everything!

Annex 8: Depicted outcome themes of the innovation groups

Changarawe	Ilakala	Ilolo
UPS 3: Maize processing	Water pump (Tuamiho)	UPS 5: Improved stove
Time Respect (heshima) Money Health (afya) School (shule)	Knowledge (elimu) Group (kikundi) Time Energy (nguvu) Money (pesa) Dependence on CC Food (sauce/ mboga)	Knowledge (Elimu) Forest (Misitu) Time Firewood Smoke Money (Pesa)
		
Bike rental business (Upendo)	UPS 1: Micro-dosing	UPS 10: HH nutrition and kitchen garden
Transport Time Money (individual and group level) Knowledge (about: bike, business)	Knowledge (elimu) Group (kikundi) Time Energy (nguvu) Dependence on CC Forest (Misitu)	Knowledge (elimu) Time Money (pesa) Dependence on CC Food (sauce/ mboga)
	