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Multi-actor analysis in the implementation of Upgrading Strategies (UPS) for enhancing food security in Tanzania: Regional differences between sub-humid Morogoro and semi-arid Dodoma.

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Introduction

Smallholder farmers in Tanzania are more and more threatened with environmental volatilities that increase the insecurity of regional food supply (Foley *et al.*, 2011). Given the challenges of increasing food demand, unpredictable climate, and rural poverty, there is a strong need to improve current smallholder agricultural production systems and thereby, to increase production, to increase the food system's resilience against future hazards and to improve rural livelihoods. The project "Trans-SEC: Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer: A people centered approach" aims to improve the food situation of the rural poor population implementing successful food securing upgrading strategies (UPS) along local and regional food value chains through a participatory platform. The UPS are tested and adjusted together with the local actors to site-specific, sustainable settings and tailored for regional and national outreach (Graef *et. al*, 2014). The research is undertaken in four villages of two districts, which are located in two agro-climatically different regions in Tanzania, Kilosa district that is within sub-humid Morogoro region, and Chamwino district in semi-arid Dodoma region. The success of the UPS to a major part relies on the interactions among the participating actors.

Research objectives

This study examines the role of actors and the interlinkages among the UPS groups in four villages in Tanzania. Specifically, it asks for the types and roles of actors in the different UPS groups and their differences in motivations for taking part in the UPS implementation, and for the influence of these actors within an UPS group.

Materials and Methods

Participatory Net-Map interviews

A total of 176 actors from 24 different actor groups were interviewed. Individual interviews were carried out for each actor followed by social mapping using the Net-Map tool (Schiffer, 2007). The results were processed by UCINET and Gephy software.

Focus group discussions

The participants of the individual interviews were called upon to participate in a Focus Group Discussion (FGD), where the Net-Map of each UPS group were discussed in order to get deeper insights into the groups'

interrelations and to provide feedback to the group members.

Results and Discussion

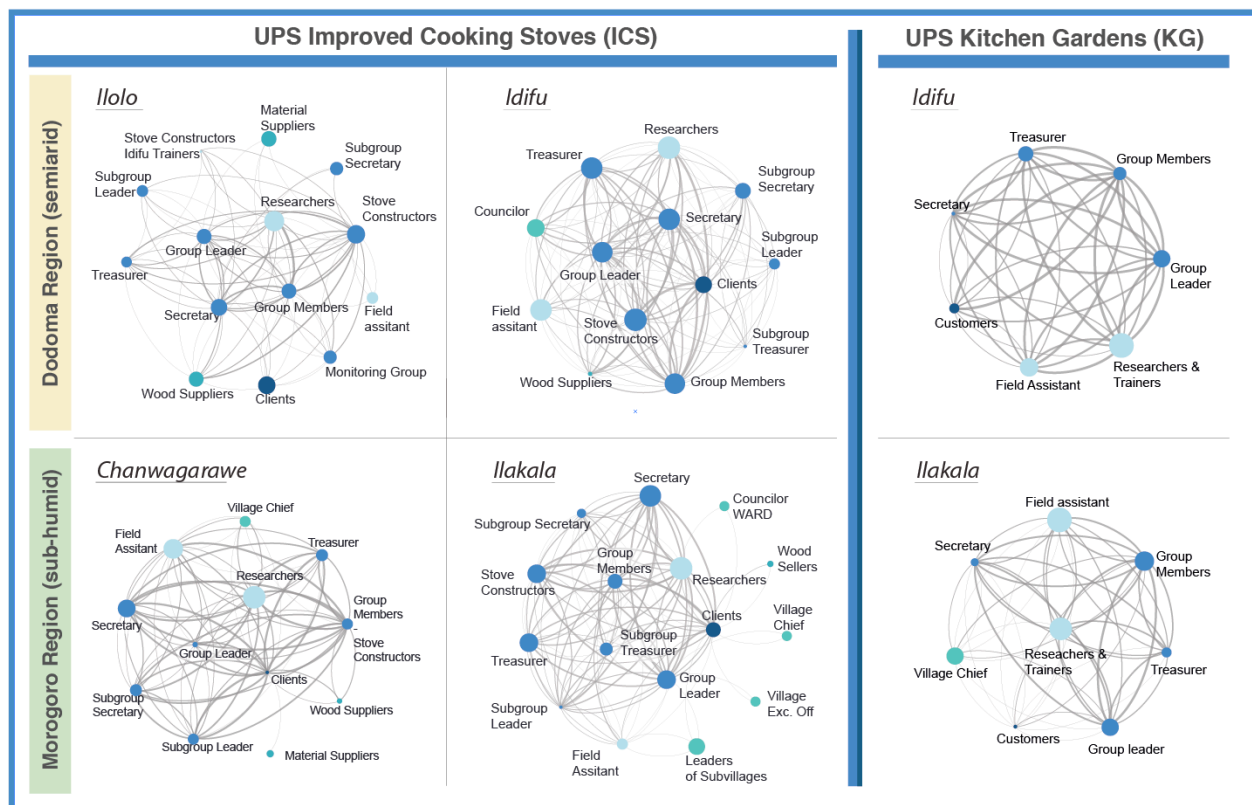
The results represent the knowledge networks of six groups in two different UPS: Improved cooking stoves (four groups) and Kitchen gardens (two groups) (Table 1).

Table 1: Upgrading strategies across FVC components and their selection (✓) in different climate regions

FVC component and upgrading strategies	Description of upgrading strategy	Sub-humid region	Semi-arid region
<i>Post-harvest processing & biomass/energy supply</i>			
Improved stoves	Small scale stoves reducing energy consumption from loam for household use with one or two holes at US\$ 3-5/stove, locally constructed by trainers training other stakeholders (Kshirsagar et al. 2014)	✓	✓
<i>Consumption</i>			
Household nutrition education & kitchen garden training	Increasing the awareness of nutrient-rich including indigenous foods, and making better use of these crops to improve nutritional status especially of under-five children (Roy et al. 2005); cultivating indigenous fruits and vegetables at the homestead for dietary diversification (Galhena et al. 2013)	✓	✓

Each group is explained by a Network map (Fig. 1), a table of the Net-Map centralities (Table 2), and the main motivations of the group members for taking part in the UPS groups (Table 3).

Figure 1. Group Knowledge Network Maps. The sizes of the nodes reflect the importance of the actors from the actors' perspective and the colors cluster them into different actor groups.



Regional differences

The flow of UPS knowledge is related to the availability of natural resources (fuel wood for ICS, leafy vegetables for kitchen gardens) in the different regions. This can be shown with two examples: a) Material and wood suppliers in ICS groups have more ties in the semiarid region, as group members are propagating their knowledge with them regarding environmental conservation, explaining them proper technics of gathering, drying and storing firewood, as well as importance of environment preservation; b) ICS clients or customers have lower importance in the sub-humid region in both UPS, as the population tends to be more reserved towards the UPS adoption. In both UPS of Morogoro Region more actors from the governmental levels are present as they are considered key actors that can support them to overcome the challenges of implementation the groups have been facing (Fig. 1).

Table 2. Group centralities knowledge networks, actors' highest ranks. The indegree centrality measures the ties where the actor receives knowledge; the outdegree centrality measures the ties where the actor provides knowledge and the betweenness indicates the actor's potential to control the knowledge flow.

Group centralities		Group Leader	Secretary	Treasurer	Group Members	Stove constructors	Clients	Researchers
Indegree	ICS Changarawe		3rd		2nd		1st	
	ICS Ilakala		3rd		2nd		1st	
	ICS Idifu	3rd	2nd		1st			
	ICS Ilolo	3rd			1st	2nd		
	KG Ilakala	2nd	3rd		1st			
	KG Idifu	2nd		3rd	1st			
Outdegree	ICS Changarawe				2nd		1st	3rd
	ICS Ilakala	2nd	3rd					1st
	ICS Idifu	2nd	3rd					1st
	ICS Ilolo		3rd			2nd		1st
	KG Ilakala	2nd	3rd		1st			
	KG Idifu	2nd		3rd	1st			
Betweenness	ICS Changarawe				2nd		1st	3rd
	ICS Ilakala	2nd					1st	3rd
	ICS Idifu	2nd					1st	3rd
	ICS Ilolo				2nd	1st		3rd
	KG Ilakala	2nd	3rd		1st			
	KG Idifu							

Differences among UPS

There are a higher number of actors in the ICS groups and they are organized differently compared to the KG groups. ICS groups are divided into subgroups that have their own internal leaders as it is considered to be more effective for the stoves construction (Figure 1). This can be mentioned as one of the factors that have lead ICS groups to reach a high number of adopters (people having an improved cooking stove), along with the fact that the innovation provides them an extra income (Table 1 & 3). The high outdegree and betweenness levels of the researchers reflect the importance they still have in the knowledge flow on the ICS groups. In ICS implementation and upscaling this may indicate some risk making the groups to some extent more dependent on the researchers' knowledge input compared to other UPS (Table 2).

Village differences

The KG group from Idifu has a betweenness centrality of 0 meaning that in this network all actors are connected with each other (Table 2), which also indicates a certain equality amongst participants. In Ilolo ICS the stove constructors (group members that have the construction skills) have become important for the groups' functioning, this is reflected in their high outdegree and betweenness centrality levels (Table 2). Group leaders and group members have a high outdegree centrality in all groups showing their engagement on the group success, providing a good outlook on the groups' chances to prevail in the future (Table 2).

Motivations

The motivations for participating in an UPS group differ to some extent between all the groups, knowledge and social relations being the most frequent. They are considered important for their personal and community development. For the ICS groups in the sub-humid region more food availability is a motivation for the reason that they save more time on cooking and they can better focus on activities that allow them to get more food (e.g. more time for farming or taking care of their personal business). For the ICS groups in the semi-arid region we find that more joy and time are important motivations as they can spend more quality time with their families in a healthier and safer environment. For the KG group of the semi-arid region the highest motivation is more food availability due to the food scarcity in the region (Table 3).

Table 3. Improved Cooking Stoves (ICS) and Kitchen Gardens (KG) group motivations (% of UPS group actors)

UPS Groups	More Money	More Food Availability	More Joy	Better Social Relations	Knowledge generation	Shock Resistance	Higher Reputation	Time Saving
ICS Changarawe	17	11	11	17	20	10	5	9
ICS Ilakala	8	11	11	19	22	9	13	7
ICS Idifu	5	10	22	18	18	11	8	8
ICS Ilolo	8	5	9	19	24	7	18	10
KG Ilakala	10	19	8	22	19	0	11	11
KG Idifu	10	29	12	14	13	3	13	5

Conclusions and Outlook

The combination of Net-Map interviews and focus group discussions enabled getting a holistic picture of the actor groups' social interconnection and reveal the ties that are being built outside of the group members to enhance the development and propagation of knowledge. The results also indicate possible bottlenecks among

the UPS groups' members, for example the actors that have a high betweenness centrality degree, which could potentially hinder the knowledge flow in the groups. Participants' motivation to improve their knowledge and social relations are a big support and incentive for the group's development and, ultimately, the UPS adoption. For a more effective support of actor performance, we recommend focusing into detail where to strengthen the capacities within the various UPS taking into consideration the regional, UPS and village differences.

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