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Networks of Rural Producer Organizations in Uganda: What Can be Done to Make Them Work Better?

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Summary. — Rural producer organizations (RPOs) are currently seen as mechanisms of reducing transaction costs and improving market access of smallholder farmers. Yet little is known about the determinants of RPO effectiveness, especially in Sub-Saharan African countries. In this article we assess functioning of Ugandan RPO using a combination of participatory research and survey methods. We recommend areas for development interventions that would enhance the positive impact of RPO on livelihoods of their members. The proposed interventions refer to monetary transactions between RPO and their members, information channels within RPO, access to inputs and finance, member knowledge capacity and motivation of leaders.

Key words — rural producer organizations, participatory methods, agricultural development, rural networks, coffee farmers, Sub-Saharan Africa

1. INTRODUCTION

The Green Revolution in Asian countries showed that reaching small farms through agricultural growth can be an effective pathway for poverty reduction (Evenson & Gollin, 2003; Hazell, Poulton, Wiggins, & Dorward, 2010). Accordingly, the *Agriculture-for-development* strategy formulated by the World Bank (2007) identifies the smallholder farm sector as the foundation for achieving the development of rural economies. Still, smallholder agriculture is often subject to inefficient allocation of goods and services and other forms of market failures. Smallholder agricultural producers are typically unable to capitalize on the benefits of economies of scale and have lower market access and bargaining power, especially in rural areas. Therefore, they face higher transaction costs in most of non-labor transactions, such as the purchasing of inputs, capital access, or the selling of output (Key, Sadoulet, & De Janvry, 2000; Poulton, Dorward, & Kydd, 2010). The need to respond to these market barriers and related government failures has led to the emergence of many grassroots farmer-controlled organizations in developing countries in the recent past (Arcand, 2002; Uphoff, 1993; Wanyama, 2008, chap. 14). Such collective action in the form of rural producer organizations (RPOs) is widely seen as a way of reducing the transaction costs of smallholders and of improving their level of commercialization by creating linkages to high-value markets (Markelova, Meinzen-Dick, Hellin, & Dohrn, 2009; Markelova & Mwangi, 2010; Shiferaw, Hellin, & Muricho, 2011; Shiferaw, Obare, & Muricho, 2008). Hence, over the past two decades governments and development agencies have put more attention in the empowerment of rural farmers and communities through collective action institutions, identifying them as important partners in the implementation of agricultural development programs (IFAD, 2001, 2010; World Bank, 2007). A lot of hope nowadays is put on RPO with regard to their potential for supporting agricultural growth, reducing poverty, providing access to services and markets, and creating employment opportunities in rural areas. For instance, the United Nations General Assembly declared 2012 as the International Year of Cooperatives, with the theme "Cooperative Enterprises Build a Better World".

Empirical evidence, however, shows that in Sub-Saharan Africa RPO have had mixed success (Akwabi-Ameyaw, 1997; Bernard, Collion, de Janvry, Rondot, & Sadoulet, 2008; Bernard & Taffesse, 2012; Fischer & Qaim, 2012; Gabre-Madhin, 2001). Scientific explanations of this evidence are scarce, since as yet little is known about the determinants of RPO effectiveness in developing countries and their ability to provide benefits for their members. The knowledge gap is caused by high degrees of complexity and diversity of RPOs and a lack of research evidence (Ragasa & Golan, 2014). This creates a need for thorough and comprehensive studies of RPO performance in order to better understand the functioning of RPOs and to design adequate measures for their support (Bernard & Spielman, 2009; Ragasa & Golan, 2014). This article contributes to the development of RPO-related knowledge by presenting and analyzing the results of our

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research of RPOs conducted in Uganda. The aims of the article are to assess the functioning of Ugandan RPOs and identify ways for their improvement. In this paper we seek to investigate what are the specifics of the researched organizations, what are their structures and surrounding environments, and what kind of services and benefits they may provide to their members. The goal of this study is to provide an understanding of what hinders the performance of RPOs in Sub-Saharan Africa, what their underutilized potentials are and what kind of development interventions could assist RPOs in tapping into these potentials.

As our research methodology we applied a combination of participatory research techniques, including participatory mapping, public goods games, group discussions, and key expert interviews. As a case study for participatory research, we focused on organizations of Robusta coffee producers from the central part of the Lake Victoria Crescent. Additionally, in this article we provide general information about RPOs in Uganda based on our estimations from household and RPO surveys conducted in Uganda by IFPRI (2010) and based on our analysis of focus group research conducted by Dejene-Aredo, Hill, Keefe, Maruyama, and Viceisza (2009).

This paper provides detailed information on the functioning of RPOs in Uganda in general and of RPOs dealing with marketing of Robusta coffee in particular. It identifies a niche for development support in the strengthening of RPO and increasing the welfare of their member farmers. To this end, we propose target areas for development interventions supporting RPO and provide practical recommendations for their implementation. The results communicated in this paper are, therefore, valuable for donor organizations and governments, as they could assist the design of the respective policies, programs, and projects.

2. RESEARCH SETTING AND THE CASE STUDY

(a) *Research project*

This study was conducted as part of the international research project, "Working together for market access: Strengthening rural producer organizations in Sub-Saharan Africa" funded by the German Federal Ministry of Economic Cooperation (BMZ) and led by the International Food Policy Research Institute (IFPRI). The project was focused on the analysis of the abilities of RPO in improving their members' access to input and output markets. Its goal was to propose viable measures that could support RPO and assess their impacts by conducting field and virtual (i.e., computer simulation) experiments. The baseline project survey (IFPRI, 2010) approached members and administrations of RPO. It was accompanied by the participatory research reported on here, which explored the functioning of RPOs and identified possible interventions for further implementation and testing in experimental set-ups.

(b) *RPO in Uganda*

The first organizations of agricultural producers were formed in Uganda during the first half of the 20th century under the British colonial government and were traditionally involved in the marketing of coffee and cotton (Kasozi, 2008; Masiga & Ruhweza, 2007; Mrema, 2008, chap. 5). Until the market liberalization reforms undertaken by the Ugandan government in 1990's, these local cooperatives had been mostly state-managed (Baffes, 2006; UCTF, 2013). Since then, the environment and functioning of farmer cooperatives has changed considerably. On the one hand, the rapid liberalization and consequent increase of market competition caused excessive failures of state-affiliated cooperatives (Kasozi, 2008; Kwapong & Korugyendo, 2010; Mrema, 2008, chap. 5). On the other hand, more limited government influence in the cooperative sector led to the emergence of member-owned grassroots RPO in the country during the 2000's (Kwapong & Korugyendo, 2010; Mrema, 2008, chap. 5). Thus, state-owned RPO were replaced by member-owned RPO. These new RPOs are autonomous entities independent of the government and intend to function as self-sustaining profit-generating businesses, unlike the RPOs from the past aimed at securing the export commodity supply (Kwapong & Korugyendo, 2010). Accordingly, the role of supporting RPOs has been assumed by various NGOs.

As was confirmed during our field research, RPO in Uganda are commonly formed around one or several agricultural commodities that they deal with (coffee, maize, sunflower etc.). Usually, producers are organized on two levels: (i) primary farmer organizations (locally called PO), unifying farmers from the same village or parish; (ii) county or sub-county-level associations, usually called depot committees (DC) or area cooperative enterprises (ACE). Typically, a PO is responsible for bulking the produce of individual farmers and coordinating transport for delivering produce to the DC/ACE. Collection of PO-gathered quantities, product transformation, value addition, coordination of market sales, and input procurement is organized at the level of the DC/ACE. Farmers, however, may deliver the produce to the DC/ACE directly, bypassing the first-level organization. The DC/ACE is a small-scale producer union consisting of several POs from the same county or sub-county. It is usually not tied to a certain buyer and is able to bargain for better deals. Further, the DC/ACE may be a member of a country or region-wide union or federation, such as the National Union of Coffee Agribusinesses and Farm Enterprises (NUCAFE), Uganda National Farmers Federation (UNFFE), and others. These umbrella organizations have advocacy and representative functions. They serve for lobbying interests of agricultural producers, further facilitating access to buyers, financial services, and certification schemes. Some umbrella organizations may have established market connections with downstream trading partners. In such a case, these organizations may also buy agricultural commodities from the DC/ACE. In order to attain a higher turnover and stimulate farmers to sell their produce through the organization, the DC/ACE may offer additional services to its members. The services are typically associated with agricultural extension and the marketing and transportation of member produce.

(c) *Case study description*

As mentioned in the previous section, present-day RPOs in Uganda are relatively new. Hence, detailed and concrete information about these organizations and their functioning has been scarce up to now. A case study research strategy is a good way to provide a first comprehension of the topic, since it allows for an in-depth analysis using multiple methods. We used this strategy in order to close the existing knowledge gaps related to RPO in Uganda. Our case study focuses on the RPO called "Kibinge coffee farmers association" (Kibinge DC), which is a sub-county-level farmer-owned organization from Kibinge sub-county, Masaka district of Central Uganda, a traditional coffee-growing area. The organization engages in the marketing of Robusta coffee, which is the main marketable

coffee species in Uganda: 78% of the coffee export volume is Robusta coffee (*Coffea canephora*) (ICO, 2014).

Our focus on RPOs dealing with coffee marketing is not accidental. For decades, coffee has been the most important cash crop and main export product in Uganda. BOU (2013) estimates that currently coffee comprises 15% of the total value of Ugandan formal exports. According to recent data from 2012, Uganda is the second largest coffee producer in Africa (after Ethiopia) and the 11th largest in the world (FAOSTAT, 2014). There are approximately 500,000 coffee-growing farms in Uganda (Baffes, 2006), growing about 310,000 hectares in 2012 with a yield of 186,000 tons of green coffee. In total, the coffee production sector provides jobs for around 3.5 million families (UCDA, 2013). In regions of Uganda that are suitable for coffee growing, coffee sales constitute a major source of income for 74% of households (UCTF, 2010). This shows the significance of revenues obtained from cultivation of coffee for a significant part of the country's rural population. Since coffee is a cash crop, according to ICO (2014), 97% of the country's coffee production was exported in the agricultural year 2011–12. This coffee was mostly grown by smallholder farmers (according to (Hill, 2010), 70% of coffee-growing households have less than 5 acres of land), making collective marketing through RPO highly important for commercialization of coffee production.

Kibinge DC was founded in 1995 and registered as a cooperative in 2008. The DC is a member of NUCAFE, and it consolidates 46 village POs and 1,716 farming households (IFPRI, 2010). The DC offers a wide range of services to its members, such as training for agricultural practices, provision of planting material and management of transportation (more detailed description of services can be found in Section 4(c)). The group claims to be one of the first in Uganda to engage in coffee certification (Dejene-Aredo *et al.*, 2009). The lands occupied by DC members lie in the central part of the Lake Victoria Crescent in a peri-urban area on the elevation of around 1250 m.a.s.l. The environmental and socio-economic situation in this domain is characterized by favorable agro-climatic conditions for crop cultivation, relatively good connectedness to input and output markets, and a prevalence of intensive coffee and banana (plantain) cultivation system (Ruecker, Park, Ssali, & Pender, 2003). The climate in the area allows for two crop-growing seasons. The main cash crop is coffee and the main staple crops are plantain, maize, and beans. The agricultural system is marked by low levels of technology use and is mainly based on manual labor.

3. METHODS AND DATA

The methodology applied in our primary assessment of RPOs in Uganda, the results of which we present in this paper, consisted of four parts: (i) survey data analysis, (ii) participatory mapping of RPO network, (iii) expert interviews and (iv) public goods games with RPO members.

Since the information about contemporary RPOs in Uganda that is available up-to-date, is scarce and scattered, obtaining an in-depth picture of RPO functioning required a combination of research methods. Including qualitative participatory methods (i.e., participatory mapping and expert interviews) in our tool kit allowed gathering knowledge of the local stakeholders such as RPO members, personnel, and related experts (agricultural development and extension workers, researchers, coffee buyers, government officials, etc). This knowledge provided first-hand insights and multiple perspectives on the research topic; hypotheses and study questions were directly assessed with the help of stakeholders, who have a broad implicit knowledge of the topic. A considerable advantage of participatory methods lied in their ability to facilitate dialog and information exchange with informants, and also to motivate their interest and engagement in future stages of the research. Furthermore, usage of participatory tools allowed for adaptation of the research to the local context, which was important, since we framed our research as a case study. Since RPO networks and processes are complex, the qualitative information, such as RPO member narratives, drawn schemes and expert opinions, were helpful for understanding RPOs.

RPO are entities emanating from collective action. Therefore, it is interesting to investigate up to which extent individual RPO members are willing to contribute to the organization. We did this by conducting public goods game experiments in RPOs and analyzed the results of the games with respect to RPO performance data.

In addition, in order to complement the research with quantitative information about RPOs in the country, we analyzed the project's RPO and household surveys. This allowed placing our case study within a broader country-level context. Also, we used the survey data to conduct the selection of RPOs for participatory research and to link the results of our public goods games with the observed choices of RPO members in coffee marketing.

The practical implementations of the applied methods and data resources are discussed in the next parts of this section.

(a) *RPO and household survey*

In the study, we analyzed the project survey (IFPRI, 2010), which was conducted in Uganda from March to April 2010 in various districts of Uganda on three different hierarchical levels: (i) county/sub-county, (ii) village/parish and (iii) farming household. The respondents of the survey were board members, administrative personnel, staff, village leaders, and regular members of RPO. On the county/sub-county level the survey interviewed 21 administrations of various DC/ACE. The majority of the sample DC/ACE (12 out of 21) was dealing with Robusta coffee. Another four dealt with Arabica coffee, four with maize, and one with plantains. For the village/parish level, the survey selected 375 POs from the 21 DC/ACE, whose chairpersons were then interviewed. The questionnaires for the PO and the DC/ACE were similar in structure and their main topics were: leadership and membership of the organization, services provided by the organization, information on the value addition and collective sales, as well as the decision-making within the organization. Two regular members were then randomly selected from the PO roster of each of the 375 POs visited. The households' 750 selected members were interviewed using a household questionnaire. This questionnaire contained questions related to household land use, crop and livestock production, labor allocation, marketing of agricultural produce, household relationships with RPO, and its use of RPO services.

(b) *Net-Map*

Our participatory research with RPO members started with a collective mapping of the coffee marketing system. For this purpose, we adapted the Net-Map Toolbox (Net-Map), a visualized participatory method of systems and networks mapping. This interview-based tool was developed by Schiffer (2007) and was successfully utilized by its creator in Ghana and Ethiopia for research of different stakeholder groups

(water user associations, education commission, fishermen community, etc.) (Schiffer, 2013; Schiffer & Hauck, 2010). The output of interactive Net-Map sessions with stakeholders is the map of socio-economic network where actors, their links, and their roles are reflected. With slight extensions the tool can be used for the mapping of processes (Raabe *et al.*, 2010). Instead of focusing on the static network, one can also focus on the system's dynamics and ask interviewees to depict a particular process by identifying interactions between actors of the mapped network over time. The Net-Map method was applied in this way for the current research.

The Net-Map was conducted once with the administration of Kibinge DC and 10 times with members of different POs belonging to the DC. We selected these POs from 36 POs of Kibinge DC that were covered by the (IFPRI, 2010) survey. From each of the selected 10 POs, five members were invited to participate in one of the respective 10 Net-Map sessions. In order to undertake a selection that can, on the one hand, provide a good statistical representation of different POs and, on the other hand, meet requirements of data availability, we applied a clustered sampling approach, using the statistical software package (Stata) in the following sequence:

1. Exploratory factor analysis of IFPRI (2010) survey data to select appropriate factors for sampling the PO.
2. Hierarchical cluster analysis and assignment of PO clusters based on the selected factors.
3. Selection of POs for the group sessions according to (i) their proximity to the cluster center (for choosing a typical PO in each cluster) and (ii) the weight of the cluster in the survey sample.
4. PO with no information on PO sales in the IFPRI (2010) survey were discarded from the selection and replaced with next closest PO to the respective cluster center (Data on sales were needed for the later analysis of public goods games).
5. The PO chairperson and four random members from the PO roster (from those with available information on coffee sales in the survey) were invited to the participatory session.

In practice the Net-Map sessions were implemented in the following steps:

1. *Introduction:* PO members invited to a session were briefly introduced to the aims of the research. The goal of the Net-Map was formulated to them as "describing and understanding the process of coffee production and marketing in Kibinge". We then wrote the goal on a blank A2 sheet of paper that was used for setting up the map.
2. *Description:* PO members were asked to describe the process of coffee production and marketing step-by-step. Every time a new actor (e.g., farmer, trader, PO chairman, etc.) was mentioned, the participants were asked to write the actor's name and draw a symbol for it on a carton card. (Drawing was needed to control for inclusion of illiterate respondents.) This card was pinned to the map sheet. Each step of the process was depicted as a link between actor cards. Every link was chronologically numbered and described in the legend on the side of the map. All process steps (i.e., map links) were qualified as necessary or optional.
3. *Re-assessment:* After the map was completed, respondents were asked to check whether certain actors or links were still missing. The missing ones were then added to the map. Also, the participants were asked about actors that are important for coffee production and the marketing process, but to whom the group does not have access (e.g., extension service).
4. *Assignment of importance ranks:* After the description of the process was finished, the participants attributed importance ranks to the actors indicated on the map. The subjective actor importance represented the influence of particular actor on the success of the process (in this case production and marketing of coffee). The ranks were assigned on a one-to-five scale (by placing dot stickers on actor cards). During assignment, the participants were also asked to provide explanations for why certain actors were relatively more important than others.
5. *Identification of hot-spots:* The participants were asked to mark the possible complications and risks in coffee production and marketing on the respective process links and to explain them.
6. *Follow-up group discussion:* After the Net-Map, we asked the participants to clarify certain aspects of the map and some production and marketing issues in general (e.g., intercropping, rate of fertilizer application, etc.). The answers were written down on the side of the map.

(c) *Public goods games*

The public goods game is a standard method of experimental economics. The results of the game show the willingness of group members to contribute to a common pool of resources of the group, reflecting the degree of trust among the members. We conducted one public goods game within every five-person group participating in the Net-Map (the selection of participants was explained earlier in Section 3(b)). The results of the games were then matched with the respective PO and household survey data on coffee sales recorded by IFPRI (2010).

When playing the game, participants used the rewards for participation in the Net-Map that they had received from us. The size of the reward was equal to 10,000 Ugandan Shillings [1] (ugx) per participant. We decided to apply monetary contributions and payoffs in public goods games in order to stimulate thoughtful behavior of the players. Each game was set up as follows:

- At the beginning of the game, all five participants received envelopes containing 10,000 ugx in 1,000-ugx notes.
- Every participant was given an option to contribute any part of the reward to the common pool under the condition that sum of individual contributions would be multiplied by 1.5 and then evenly divided among all five participants at the end of the game.
- Thus, individual payoffs (P) could be derived from individual contributions (C) as:

$$P_n = 10,000 - C_n + \left(\sum_{i=1}^{5} C_i * 1.5\right) \Big/ 5$$

- Members were informed that their contributions would remain secret from everybody except the researcher. Members transferred their contributions to the common pool in sealed envelopes provided to them. The inner side of each envelope contained an identification number of the corresponding member, so we could then identify contributions of particular members.

(d) *Interviews with key expert informants*

Along working with RPOs, we approached experts from various organizations related to RPOs dealing with Robusta coffee for semi-structured discussion interviews. For each interview a separate discussion outline was prepared. In order to utilize the different expert knowledge of respondents and broaden the obtained insights, the topics covered and questions asked were respondent-specific. Table 1 contains information about the discussion topics. In total, 21 key informants were approached during 14 interview meetings. Some were interviewed as a group, others individually. The selection of experts for the key informant interviews was based on research contacts and the availability of the informants.

4. RESULTS

(a) *RPO formation and membership*

According to our analysis of IFPRI (2010) survey data (see Figure 1), the vast majority of currently functioning RPOs were established after 2000. According to Figure 2, most of the present-day RPOs in Uganda are self-organized. Yet, from IFPRI (2010) we estimated that 76% of RPOs received external help during their establishment. Figure 3 shows the objectives that were pursued when establishing the RPO. From the figure it can be seen that every sampled RPO organized itself in order to fulfill the requirement of a service provider or apex organization in the value chain. Among the RPOs, a large majority of 86% stated that value addition and collective marketing were their primary objectives. Only about 5% of RPOs were organized for collective savings.

The number of members in each DC/ACE varies significantly, from around 150 farmers in the smallest DC/ACE up to around 3,000 farmers in the larger ones (Table 2). The

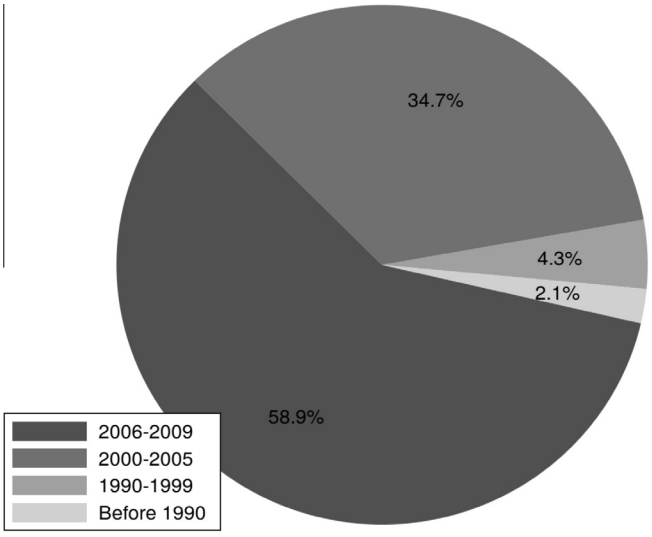

Figure 1. *Time of RPO formation. Source: Own calculations, based on IFPRI (2010).*

number of members in a given PO does not differ much, though, amounting to 10–40 members. The representation of women and youth in a given RPO, however, is quite heterogeneous. On average, each sampled DC/ACE comprises 36% female members and 25% young members (24 years of age and younger), with 31% and 30% as medians, respectively. One DC/ACE joins together 23 POs on average, and 17 POs on median.

As mentioned above, value addition is one of the main objectives declared by present-day RPOs. During the IFPRI (2010) survey, regular farmer members of RPOs were asked if membership in an RPO increased the price that farmers

Table 1. *Key informant interviews. Matrix of topics*

Topic	Interview number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Casual labor												x		
Certification and quality incentives								x	x	x	x			
Coffee pests and diseases					x	x						x		
Coffee price formation and trends	x	x	x	x		x			x					
Coffee-banana intercropping			x		x	x			x			x		
Cooperative savings								x			x			
External development interventions								x		x	x	x	x	
Factors determining coffee yield					x	x			x			x		
Factors for RPO sustainability and success		x						x		x	x			
Farmer problems and constraints							x					x	x	x
Group decision-making and actions			x	x		x	x	x			x			
Harvesting of coffee	x			x								x		
Incentives to act as a group				x				x		x	x			
Information channels		x						x						
Institutional framework							x							x
Investments in new coffee plantations					x									
Planting material for coffee						x			x			x		
Production inputs				x		x			x			x		
RPO functionality and services			x		x		x	x			x		x	x
RPO leadership								x			x			
RPO problems and constraints		x						x		x	x		x	x
Sales channels	x	x	x	x						x	x	x	x	x
Transportation	x	x												

Source: Authors, based on the interviews with key informants.

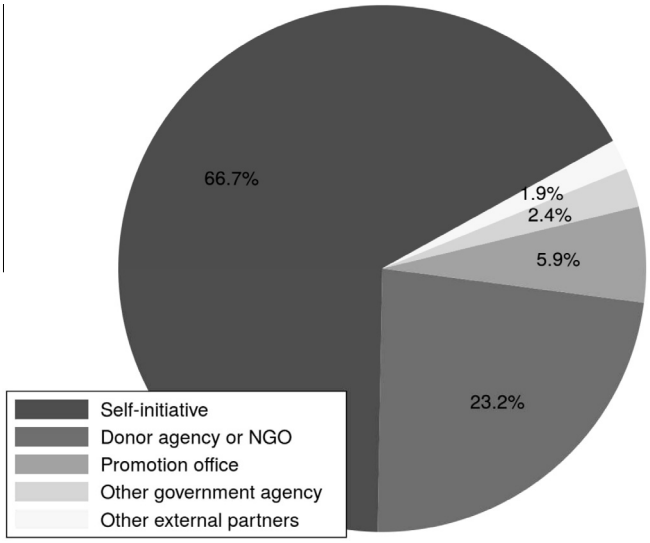

Figure 2. *Initiative to establish an RPO. Source: Own calculations, based on IFPRI (2010).*

received for their produce. Figure 4 presents the farmers' opinions recorded on the Likert scale. As the results from the figure show, 71% of RPO members either agree or strongly agree with the statement, "being a member of an RPO has increased the price I receive for my goods". An additional 12% slightly agreed with the statement, while about 6% were neutral and 11% disagreed, slightly disagreed, or strongly disagreed.

(b) *Structure of the RPO network*

Kibinge DC is a formal organization with an open and voluntary membership. It is a cooperative of Robusta coffee growers and deals only with this commodity. In order to be a member of the DC, a farmer must possess at least two shares of the DC worth 5,000 ugx each and pay annual membership fees in the amount of 2,000 ugx. These fees are used for administration salaries, maintenance of the DC office and storage facilities, organization of member meetings and payment of electricity and telephone bills. The DC's profits are usually spent either on dividends or small investments (stationery, office equipment). Important decisions (e.g., board elections) are made at annual or special meetings by a vote of members (every member has one vote, irrespective of the number of shares he or she holds). Kibinge's organizational structure comprises a chairperson, a vice-chairperson, a secretary, a treasurer, and an executive committee, all elected by the farmers' assembly. The executive committee includes an executive manager, a field officer, and an accountant, whose salaries are paid from the DC budget.

Figure 5 contains the output map of the Net-Map session conducted with the DC administration. It displays the process of coffee production and marketing in Kibinge sub-county and characterizes the involvement of RPOs in the process. The legend of the map is organized sequentially, describing the

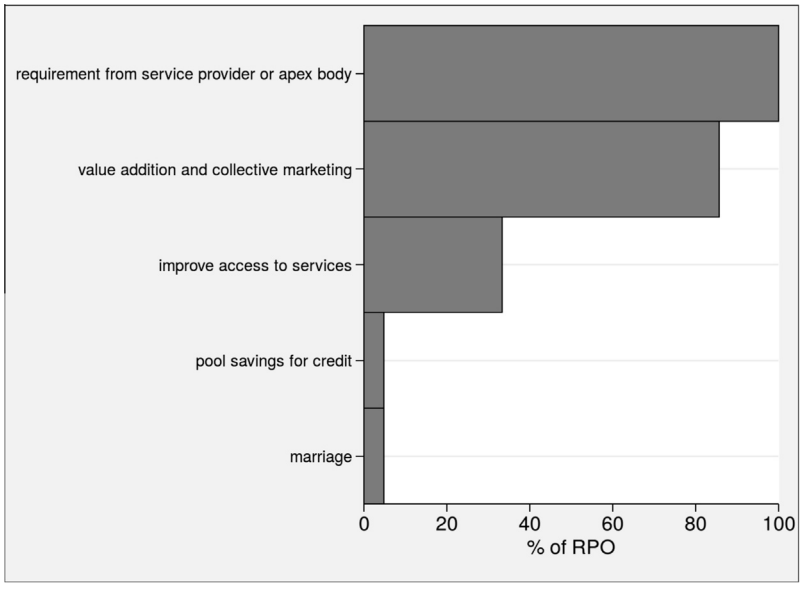

Figure 3. *Objectives of RPO establishment. Source: Own calculations, based on IFPRI (2010).*

Table 2. *RPO membership*

	Members in DC/ACE	Women in DC/ACE, %	Youth (<24 yrs) in DC/ACE, %	PO in DC/ACE	Members in PO
Mean	1,006.6	36.4	25.3	23.3	33.8
Median	550	31.4	29.8	17	24
10th percentile	154.5	18.4	8.3	9	12
25th percentile	251.5	25.7	10	12	16
75th percentile	857.5	44.4	36.6	27	30
90th percentile	2,975	70	40	35	37

Source: Own calculations, based on IFPRI (2010).

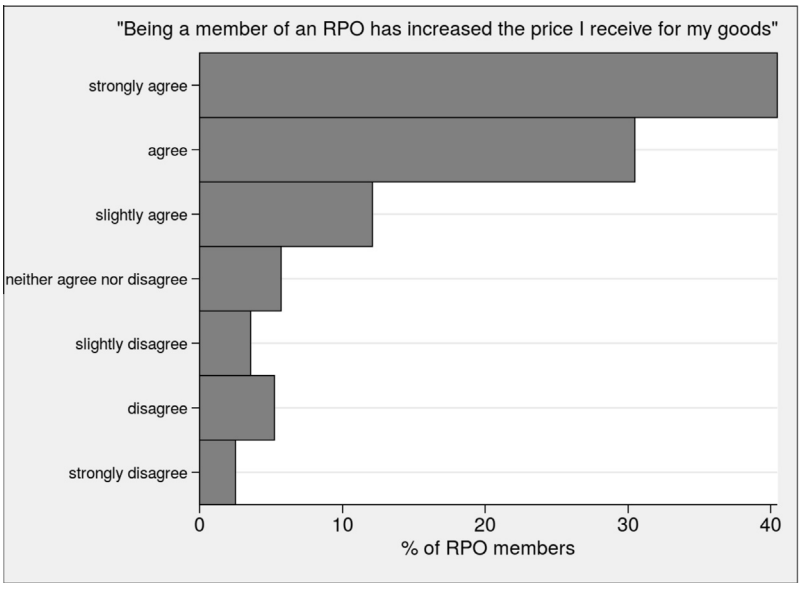

Figure 4. *Opinion of RPO members. Source: Own calculations, based on IFPRI (2010).*

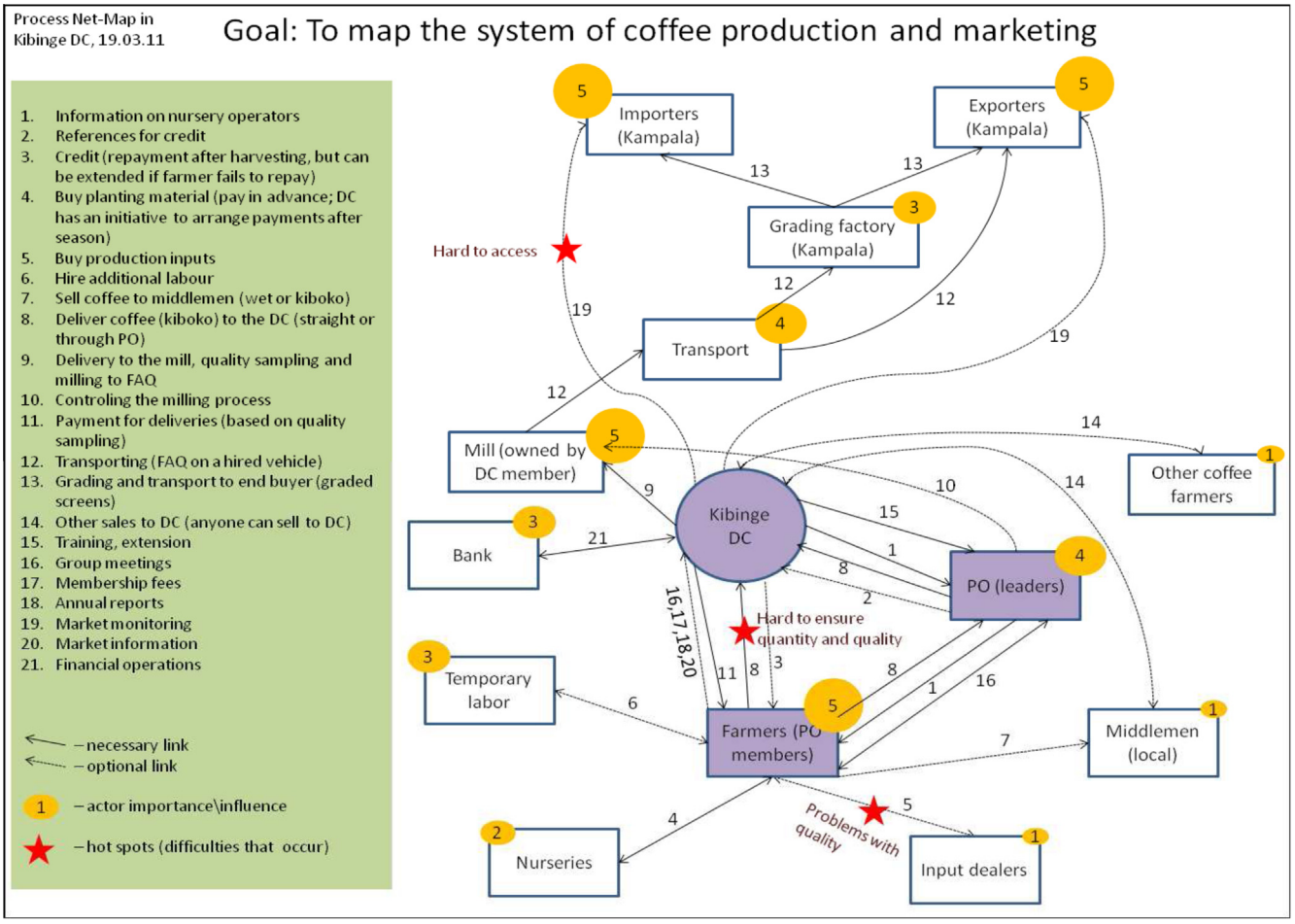

Figure 5. *Kibinge DC. Network map. Source: Authors, based on the Net-Map results.*

process flow from procurement of production inputs to final sales. The map also indicates importance of particular actors and identifies hot spots in the business system of the DC.

The Net-Map sessions in the selected 10 primary POs produced maps similar to the one depicted in Figure 5, although the drawn networks were not exactly the same. Some of the

POs did not have certain actors in their networks (e.g., nurseries or input providers), while other actors were linked to additional nodes (e.g., development support or parish administration).

Table 3 lists actors who were reported by PO members to be involved in the process of production and marketing of coffee. This table reports how often specific actors were mentioned during our Net-Map sessions. Also, the table contains the mean of importance ranks (on a 1–5 scale, with 5 having the highest importance) that were assigned to the mentioned actors by PO members. Accordingly, the DC and the milling facility have the highest importance, equaling a score of almost 5. Such a high perceived importance (as explained by Net-Map participants) was due to the large value addition that can be achieved in coffee processing and collective marketing. In other words, these specific actors are crucial for increasing farmer profits. In terms of importance, they are followed by the PO members themselves, because PO members define the coffee quantities that the DC sells and have collective control over DC management. In addition, Table 3 shows that farmers in some POs do not have access to such important determinants of agricultural production as agrochemicals (linked in six maps) and financial services (linked in four maps).

(c) *Services provided by RPO*

The RPO network offers a number of services to its member farmers. In the IFPRI (2010) survey the interviewed DC/ACE administrations were asked about the services provided by their organization. The reported services are listed in Table 4. As the table shows, the most common services of sample DC/ACE are agricultural extension (95% of DC/ACE), output bulking and marketing (91%), provision of market information (81%), paying cash on delivery (52%), and output transportations (52%).

In our case study, during the follow-up discussions (the last stage of the Net-Map session) we asked the visited DC administration and PO members to describe the services that Kibinge DC provides. As a result, we outline the following portfolio of services that the DC currently provides to its members:

Table 3. *Actors in coffee production and marketing*

Actor	Mentions ($n = 10$)	Mean importance
DC	10	**4.8**
Farmers (PO members)	10	**4.0**
Local middlemen traders	10	2.6
DC-affiliated mill	10	**4.8**
Temporary labor	10	2.6
Transport for coffee	10	3.1
PO (leader)	9	3.8
DC-affiliated nurseries	8	3.6
PO (board)	8	3.9
Other local nurseries	7	2.7
Providers of agrochemicals	6	3.0
Providers of manure	5	3.8
Other farmers	5	2.0
Financial institutions	4	3.0
Promoter (parish administration)	3	3.3
Development support	2	3.0
Field officer	2	3.0

Source: Authors, based on the Net-Map results.
The values with mean importance ≥ 4 are highlighted in bold.

Table 4. *RPO services*

Service	Frequency	Percent
Agricultural extension	20	95.2
Output bulking and marketing	19	90.5
Provision of market information	17	81
Paying cash on delivery	11	52.4
Output transportation	11	52.4
Input procurement	10	47.6
Processing	8	38.1
Savings accounts	7	33.3
Credit provision	5	23.8
Certification	5	23.8
Warehouse receipt system	4	19
Output grading	3	14.3
Emergency funds	2	9.5

Source: Own calculations, based on IFPRI (2010).

- *Provision of planting material:* The DC provides farmers with coffee seedlings and cuttings produced in the local nurseries. The DC staff monitors the quality of the planting material.
- *Seasonal credits:* No-interest credits for productive purposes are provided to member farmers at the beginning of the growing season from DC operational capital. Credit is approved on an individual basis, depending on the history of borrower's sales through the DC and his/her expected coffee harvest.
- *Market information:* Farmers may request actual coffee prices from the DC by telephone call.
- *Transportation of farmers' produce:* The DC organizes a pickup of dried coffee from PO members with a hired truck. The pickup schedule depends on the quantities that are ready for transportation at the PO.
- *Milling:* The DC organizes milling of dry coffee beans at a local mill. The cost of milling is subtracted from the sales price that farmers receive for hulled coffee beans sold.
- *Group certification:* Through NUCAFE, the Kibinge DC was linked to the "UTZ Certified" sustainability certification scheme. Several PO members underwent the initial trainings and are currently able to sell their coffee under "UTZ Certified" label and, thus, increase the value of their produce. The DC field officer has to assure farmers compliance with the code of conduct.
- *Payment at the time of delivery:* The DC occasionally (subject to cash availability) provides payments for the coffee on the day farmers deliver it to the DC (normally the payment is postponed for up to one month). However, if enough operational capital is available, the DC would be amenable to organizing "on the spot" payments for all DC – member transactions.
- *Farmer rewards:* In order to motivate the farmers to join and sell their produce through it the DC occasionally pays price premiums for large quantities delivered or hands out various useful materials (e.g., drying tents) to its members.

(d) *Problems and limitations of RPO*

During the IFPRI (2010) survey campaign, managers of DC/ACE were asked to list the three most important constraints that their DC/ACE was facing. We summarize the outcomes of these self-assessments in Table 5. The most frequently mentioned constraints were liquidity (reported by 57% of managers) and own capital (24%), transportation (52%) and lack of storage capacity and packaging materials (38%). There are also problems, which despite being rarely mentioned, received high importance rankings, as their

Table 5. *Constraints of RPO*

Constraint	Frequency	Percent	Mean rank[a]
Liquidity	12	57.1	1.9
Transportation	11	52.4	1.7
Lack of storage capacity and packaging materials	8	38.1	1.6
Capital	5	23.8	1.8
Lack of processing facilities	3	14.3	2.3
Low quality of produce	3	14.3	2
Price uncertainty	2	9.5	2.5
Inability to offer competitive price	2	9.5	2
Lack of market information	2	9.5	1.5
Lack of production-related information	1	4.8	3
Crop diseases	1	4.8	3
Competition with middlemen	1	4.8	3
Bad image of cooperatives from the past	1	4.8	3
Low qualification of personnel	1	4.8	2
Limited trust among members	1	4.8	1
Poor management skills	1	4.8	1
Problems with electricity supply	1	4.8	1

Source: Own calculations, based on IFPRI (2010).
[a] Rank 1 indicates the most important constraint; 2 – second most important; 3 – third most important.

occurrence might lead to notable decrease in the efficiency of the RPO. Such constraints include mistrust among members, poor management skills, and low access to market information.

During the Net-Map sessions, members of primary-level POs were asked about the problems that they faced in the production and marketing of Robusta coffee. The mentioned problems were marked on the collectively produced RPO network maps. We summarize these self-reflected problems in Table 6. The table shows that the frequently mentioned problems are associated with procurement of fertilizers (eight out of 10 POs reported it as a problem), procurement of planting material (eight POs), sales though middlemen (six POs), transport (four POs) and coffee diseases (three POs).

Administrative staff of the Kibinge DC indicated input and output quality as a common problem in production and marketing of coffee during their Net-Map session (output map in Figure 5). They mentioned as well that attracting farmers to sell their output through the DC is hard and farmers often opt out of selling though the DC, instead selling to local middlemen. The access to large buyers from the top of the value chain (i.e., foreign importers) was also referred to as a problem.

In the following, we describe in more detail the problems and constraints that the coffee RPOs are facing in Uganda. We synthesized the descriptions based on the respondent narratives collected during the Net-Map sessions and key informant interviews, as well as our own observations and conclusions made after the discussions with RPO managers, RPO member farmers, and the related experts.

(i) *Input access*

Table 6 shows that for a large portion of PO (eight out of 10) problems arise during the procurement of fertilizer and seed. In the case of fertilizer, seven POs attributed the access problem to the relatively high prices of fertilizer. Despite the fact that nitrogen fertilization usually results in a steep yield increase of Robusta coffee (Musoli, Hakiza, Birikunzira, Kibirige-Sebunya, & Kucel, 2001, chap. 25), fertilizers are rarely applied by Ugandan coffee farmers. (We estimated from IFPRI (2010) that mineral fertilizers were applied on only 17% of the plots.) The relatively high fertilizer price in rural areas is caused by the underdeveloped transportation and market infrastructure in these areas. Therefore, when farmers procure fertilizer on their own, the transaction and transportation costs of fertilizer are often prohibitively high. In addition, although the DC organizes the provision of planting material to its members, its procurement was often listed as problematic (eight out of 10 POs). This was mainly due to the prices for seedlings or the long distance to nurseries (five POs), as well as for the insufficient amounts provided at the planting period (two POs). Both planting material and fertilization are among the major determinants of coffee yield (Musoli *et al.*, 2001, chap. 25), therefore we expect the limited access to inputs to be a significant production constraint. Self-assessment results from Table 6 suggest that the DC is currently unable to fully satisfy its member needs with regard to

Table 6. *Problems of RPO members in production and marketing of Robusta coffee*

Problem description	Mentions ($n = 10$)
Fertilizers	8
Fertilizers are not always affordable (price)	7
No access to fertilizers	1
Planting material	8
DC seedlings/cuttings are not always affordable (price)	3
Nurseries are not easily accessible (distance, price)	2
Cannot get sufficient seedlings/cuttings from DC	1
No capacity to have own nurseries	1
DC does not provide seedlings/cuttings at right time (too late)	1
Sales through middlemen	6
Middlemen traders encourage bad practices and low quality	2
Unfair prices from traders (farmers have no bargaining power)	2
Traders cheat with weighing scales	1
Traders take advantage of farmers' problems (urgent cash needs)	1
Transport	5
Transport is expensive, prefer DC to have own vehicle	3
Price for DC transport is not fair	1
Transport is not very reliable, when the PO organizes it for itself	1
Labor	2
Laborers are scarce and costly	1
Liquidity problems do not allow for the hiring sufficient labor	1
Credits	2
High interest on microfinance credits	1
No link to long-term credits	1
Other issues	8
Coffee wilt disease	3
Coffee thefts	1
DC management does not treat members equally	1
Hard to attract other farmers to join RPO	1
Milling is expensive, prefer DC to own a mill	1
Weak linkage to large buyers	1

Source: Authors, based on the Net-Map results.

production inputs. Inability to purchase required amounts of fertilizers and planting material is also closely related to the financial constraints of farming households (described in the paragraph "Liquidity and access to capital" below).

(ii) *Competition with middlemen*

RPO members reported to generally prefer selling their produce through the DC, mainly because it is able to offer higher prices (because of extra value addition). However, in reality RPOs are facing strong competition for member produce from local middlemen and traders and, despite price incentives, farmers often choose to sell through middlemen. Table 7 shows that just 52% of total Robusta coffee produced by RPO members is actually sold through the RPO-channel, which indicates rather tough competition with local traders. The main reasons that cause RPO members to sell through middlemen are:

- Lack of operational capital and low credit availability forcing farmers to make informal future contracts with middlemen in order to obtain cash before the harvesting season starts.
- High time preference: Waiting for the RPO sales takes time (up to several weeks), while traders can be accessed immediately.
- Small trader margins: The prices that middlemen offer are highly competitive.
- Unexpected cash needs: Farmers are often forced to make quick informal contracts with middlemen. Also, farmers may have to sell coffee to traders that is not fully dried (RPOs typically accept only properly dried coffee) in order to get cash quickly in case of emergency. (Refers to the response, "middlemen traders encourage bad quality," in Table 6.)

(iii) *Liquidity and access to capital*

As discussed in the previous paragraph, farmers often sell to middlemen instead of to RPO because of their immediate financial obligations. Informal credit from middlemen cannot be fully substituted by credit from the DC, which only finance input purchases (not consumption needs) and are generally small and not easy to obtain. Immediate cash needs are neither met by microfinance credit, which are also small and not accessible to all farmers. Limited liquid assets of the DC, in turn, do not allow providing larger credit to its members: Table 5 shows that liquidity is the most frequently mentioned RPO constraint. The limited liquidity of farming households compels them to practice a low-input/low-output type of agriculture. (According to Van Asten, Wairegi, Mukasa, and Uringi (2011), average yields of Robusta coffee in Uganda are as low as 1.09 tons of green bean per hectare per year for intercropped plantations and 1.25 for monocropping.)

(iv) *Knowledge capacity*

Key informants admitted the lack of farmer knowledge on effective fertilizer application. Therefore, due to improper fertilizer choice and/or use, the attainable yield potential is not fully tapped. Many farmers do not fully perceive the benefits of mineral fertilizer application, although in general coffee responds well to mineral fertilizers and its use, when applied correctly, usually pays off. Also, the absence of knowledge of the soil properties of farmer plots results in suboptimal fertilizer practices by farmers. Currently, there are only two stations for soil analyses in the country (in Kawanda and Makerere). Hence, the vast majority of the farmers are unable to get information on their soils and reception of site-specific fertilizer recommendations. In addition, the RPO members indicated that their inability to cope with coffee wilt constitutes a major problem. This problem is likely to have a significant adverse effect on coffee production (Baffes, 2006).

(v) *Primary-level leadership*

Managers of the Kibinge DC and several key informants informed us that PO leaders and village heads play a key role in attracting farmers to the RPO marketing channel. They promote RPO services at the village level and provide understanding of their benefits for the farmers, with the result that farmers sell more produce through the RPO-channel. This in turn directly influences RPO profits, because RPO benefit from increased quantities through fixed cost degression and higher bargaining power. However, since RPO bulked quantity is the sum of production volumes of many primary POs (46 in Kibinge case), the monetary gains for individual PO leaders and village heads resulting from their efforts are negligible. Due to the opportunity cost of time and these low returns, the leaders are not contributing much to the empowerment of the RPO network.

(vi) *Transparency and information exchange*

In our discussions with RPO members, we observed a lack of understanding regarding the functionality of the DC on the side of regular members, which might then lead to mistrust. The reason for this is the absence of clearly communicated rules and transparency regarding the provision of DC services and benefits. For example, the DC provision of planting material and seasonal credit does generally not follow any systematic rules. The DC officers decide on every service request on their own. Further, regular transportation and payment schedules are absent. Therefore, RPO members cannot plan their cash flows and production in advance and this uncertainty leads to rumors of the DC favoring certain farmers and discriminating against others. According to farmer opinion, similar issues apply to the ongoing certification program that, as they stated, was not well communicated to them. The benefits of certification and ways to get their produce certified were unclear to most of the interviewed PO members. Apparently, the existing communication of the DC through member meetings and leaders of POs is not effective in informing farmers about the various services that the RPO network provides.

(viii) *Low physical capital of RPO and reluctance for long-term investments*

Since milling and transportation facilities are often used in the DC cycle of operations, it might be profitable for the DC to own them. Such propositions were made by the DC management and some POs (four out of 10 would prefer the DC to own transport or mill). As the DC managers, however, mentioned in our interviews RPO members are reluctant to make long-term investments into the organization and the largest part of the DC profits are redistributed among RPO members. Therefore, up to date no significant collective investment projects took place in the DC. In fact, this is a recognized problem of RPO and other cooperative firms in general (Chibanda, Ortmann, & Lyne, 2009; Nilsson, 2001). It is caused by the limited planning horizons of RPO members (limited to the proximate duration of membership) and RPO management (limited to the length of their elective terms).

(e) *Outcomes of public good games*

In the public goods games, the contributions of participated individuals varied. As can be seen in Figure 6, PO members decided to contribute between 20% and 90% of the received

Table 7. *Sales of Robusta coffee*

Coffee product	Sales channel		Total, %
	To middlemen, %	Through RPO, %	
Wet coffee	0.5	0	**0.5**
Dried cherries (kiboko)	46.9	46.3	**93.2**
Dehusked beans (FAQ)	0.5	5.8	**6.3**
Total	47.9	52.1	100

Source: Own calculations, based on IFPRI (2010).
The totals of individual product groups are in bold.

Table 8. *Public goods games. Contributions by PO (in 1,000 ugx)*

PO number	Sum	Mean	Min	Max	Sd
1	19	3.8	2	6	1.6
2	30	6	5	8	1.4
3	27	5.4	4	7	1.1
4	30	6	5	7	1
5	24	4.8	3	6	1.1
6	27	5.4	4	8	1.5
7	21	4.2	3	5	0.8
8	17	3.4	2	9	3.1
9	26	5.2	3	8	1.8
10	32	6.4	3	8	2.1
Mean	25.3	5.1	3.4	7.2	1.6

Source: Authors, based on the results of public goods games.

amount of cash into the common pool. Figure 6 also shows that a 50% contribution was by far the most popular choice among the participants. This "fifty–fifty" strategy was used by 38% of the sample. Interestingly, the most frequently chosen "fifty–fifty" strategy of public goods games correspond to the choices that PO members made, when selling their coffee. Table 7 shows that 52% of the coffee was sold through RPO networks and 48% was sold to middlemen.

Table 8 indicates the contribution amounts across the various POs. On average, each group collected in the common pool 25,300 ugx from the distributed 50,000 ugx, which results in a mean member contribution of 5,100 ugx.

The results of the public goods games were linked with the statistics on coffee sales collected by the IFPRI (2010) household survey. Since only two members of each PO were approached by the IFPRI (2010) survey and not every member was willing and/or able to provide estimates about his or her sales to middlemen, the data on member coffee production were limited. Nevertheless, linking public goods game outcomes with production and delivery data from the survey provided three types of data for subsequent analysis:

- Individual game contributions of the PO member and his or her individual sales through the RPO-channel in absolute terms (48 observations).
- Group contributions and group sales through the RPO in absolute terms ("group sales" refer to the sum of sales by participants of the game, not all PO members) (10 observations).
- Individual game contributions of the PO member and individual sales through the RPO-channel as a share of total coffee sales of the respective PO member (12 observations)

In order to reveal the correlations between game contributions and coffee sales, two non-parametric tests were applied, namely Spearman's rho and Kendall's tau. Table 9 reports test error probabilities for rejecting the null hypothesis of selected variables x and y being statistically independent. Test results in Table 9 show that both tests may reject the null hypothesis at 5% significance level in the case of testing group sales (y) *versus* standard deviation of PO member contribution at the group level (x). Hypothesis rejection at the 10% level could be done by both tests in the case of group sales (y) *versus* range of PO member contributions at the group level (x).

Having evaluated the model fit (R-squared) using different combination of variable pairs, Table 9 shows that out of all independent variables tested, "standard deviation of group contribution" is the best descriptor of the dependent variable "group coffee delivery". Our explanation is that this characteristic of group contributions is less affected by the normal "fifty–fifty" response of the game (displayed in Figure 4). Table 10 presents the estimated simple linear regression model. F-test statistics of the model are significant at the 5% level and both the constant and intercept terms are also significant at the 5%

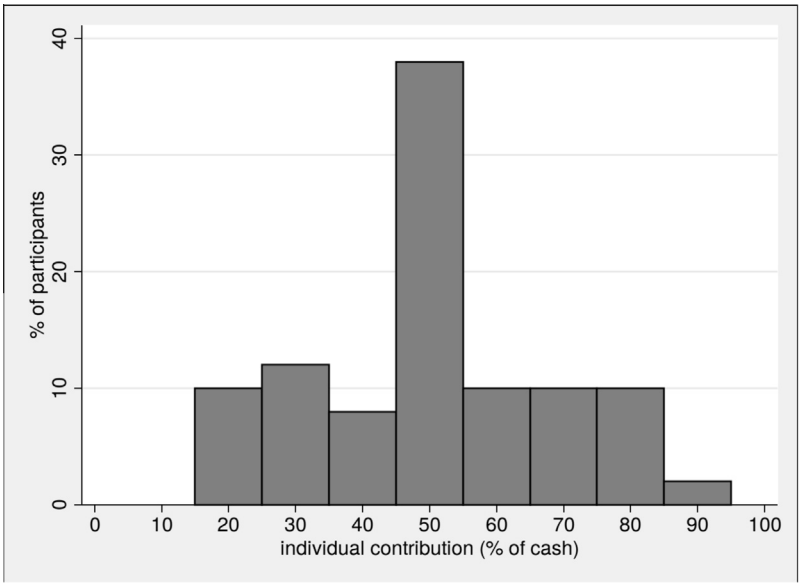

Figure 6. *Public goods games. Individual contributions. Source: Own calculations, based on the results of public goods games and IFPRI (2010).*

level. The sign of the intercept term is negative, which suggests that the amount of coffee sold through the RPO channel is negatively related to the standard deviation of the group contribution in public goods game. If we take the standard deviation of member game contributions within a group as a proxy for the diversity of member willingness to contribute to the group capital, then we could say that this diversity within the group negatively affects the amount of coffee sold through the group.

Table 9 shows no correlation between individual game contributions (y) and the volume of individual sales through the RPO-channel in absolute terms (x). This was probably because the independent variable in this case does not consider the total production of the member, unlike the case in which the contribution is expressed in relative terms as a share of production sold through the RPO. Unfortunately, due to the lack of information in the survey, the calculation of this relative measure was possible only for a very small sample (12 observations). In this limited sample no correlations for this variable were discovered.

5. DISCUSSION

(a) *Interpretation of results*

Our results (Section 4(a)) show that since the early 2000's a significant number of RPO were newly formed in Uganda. Their main declared objectives are the provision or access to services and the collective marketing of agricultural commodities. RPOs are offering a wide range of services to their members, from provision of market information to participation in certification programs. So far, RPOs have succeeded in improving the commercialization of rural farmers by enabling them to receive better sales prices due to the effects of bulking and value addition. However, RPOs experience difficulties in the provision of additional services to members, particularly in such services as input procurement, transportation, and credit provision. The problems arise mainly due to limited liquid and physical assets and a lack of commitment from RPO members. It is not yet clear if in the near future RPOs will be able to solve these problems on their own and improve the quality of their services or if their services will remain underdeveloped without further intervention.

Based on the insights on RPO that we gained from our research in Uganda, we recommend the following of areas where development interventions are likely to be effective:

(i) *Payment "on the spot"*

Our discussions with key informants and RPO members indicated the importance of timely payments of farmers. Selling through the RPO implies a certain delay in payment (due to coordination of the collection of individual produce, product transformation, and financial operations), while farmers are usually paid "on the spot" when selling to middlemen. Given the high rates of time preference of farmers in Sub-Saharan African countries (Holden, Shiferaw, & Wik, 1998), even small time delays may significantly discount the value of future payments, thus discouraging farmers from using the RPO for sales of their produce. Shortening the time that farmers have to wait to receive payments from the RPO may therefore increase their willingness to market their produce through the RPO, thereby increasing the RPO turnover and, finally, allowing the RPO to benefit from fixed cost degression and improved bargaining power. This would result in the RPO being able to pay higher producer prices to its member farmers, leading to a higher share of local produce being sold for better prices. Therefore, implementing producer payments "on the spot," which would require an increase in RPO working capital, is expected to be beneficial for both the RPO itself and its members.

One way to achieve an increase of RPO working capital is to negotiate pre-payment terms with coffee buyers. In this case, the RPO selling "history" could be used to provide assurance for the buyers. Formal contract agreements between buyers and county-level RPO could also serve as assurance. Closer integration of RPO with export chains is generally recommended in the literature (Fischer & Qaim, 2012; Markelova & Mwangi, 2010). Another option of increasing capital endowment is taking credits from financial organizations; here umbrella organizations or related NGOs can act as facilitators. The third option is improvement of efficiency of sales cycles through employing a good product collection system, motivating timely deliveries from members and organizing frequent sales transactions with buyers. Researches of Ragasa and Golan (2014) and Bernard *et al*. (2008) show that involvement of external organizations (NGO, government agencies, etc) in setting-up RPO management and operation models is beneficial for the RPO performance.

(ii) *Improvement of information channels*

In our case study we found out that RPO members lack an understanding of the services that the RPO provides. Imperfect information and non-transparency of management decisions tend to decrease members' trust and their willingness to participate in RPO.

Improvement of downward accountability by the introduction of more frequent and formal reporting could create additional trust and understanding in RPO, which would motivate members to sell larger shares of produce through RPO and make long-term contributions to the capital of RPO. In addition to annual meetings, information on RPO functionality could be spread via post and/or SMS. Writing of formal association documents and regulations of RPO services and their distribution among members could certainly improve the awareness of members to RPO functions and the transparency of the organization. The role of the outside support here lies in improving the capacity of RPOs to develop their own accountability rules and methods, and not in imposing external rules (Markelova *et al*., 2009).

(iii) *Motivating leaders of primary RPO and village heads*

In the RPOs of this case study, the important function of village-level RPO leaders does not correspond with the remuneration they receive. This discrepancy consequently results in low contribution and commitment from village-level leaders. Still, as findings of Miiro, Mazur, & Matsiko, 2012 suggest, the personal effort of RPO leaders is decisive for the knowledge transfer within RPOs in Uganda. Hence, the development of a system that would motivate leaders might be beneficial for the RPO as a whole, given the discussed importance of these leaders. Such a motivation system could be monetary or service-based (i.e., leaders get paid or get preferences in reception of RPO services).

(iv) *Disseminating knowledge through RPO*

The results of our study show that RPOs are quiet successful in attracting farmers to their networks. Therefore, as previously suggested by Hazell (2005), RPO networks could be used as vehicles for reaching smallholder farmers by agricultural extension services and development agencies. In the situation where farmers are already organized and interlinked under

Table 9. *Tests for statistical dependency. Error probabilities*

Variable *y*	Variable *x*	*N* obs	Rho test	Tau test
Individual delivery	Individual game contribution	48	0.821	0.734
% of individual delivery in total sales	Individual game contribution	12	0.392	0.477
Group delivery (sum)	Group game contribution (mean)	10	0.443	0.589
Group delivery (sum)	Group game contribution (max)	10	0.356	0.35
Group delivery (sum)	Group game contribution (min)	10	0.247	0.302
Group delivery (sum)	Group game contribution (sd)	10	**0.054**	**0.049**
Group delivery (sum)	Group game contribution (range)	10	**0.077**	**0.098**

Source: Own calculations, based on the results of public goods games and IFPRI (2010).
The error probabilities < 0.1 are in bold.

Table 10. *Simple linear model of coffee sales through the RPO-channel*

Dependent Variable = Sum of game participant sales through the RPO, kg of green coffee	Coef.	SE
Log10 (std. dev. of group contributions)	−1,811.6**	(770.2)
Constant	14,883.3**	(5616.6)
F-test	5.53**	
R-squared	0.4087	
Number of observations	10	

Source: Own calculations, based on the results of public goods games and IFPRI (2010).
** Implies significance at 5%-level.

the umbrellas of RPO, we can expect a faster dissemination of knowledge and higher adoption rates of agricultural innovations (Fischer & Qaim, 2012). Improving the knowledge capacity of RPO members (e.g., about sustainable land management, technological innovations, quality standards, certification mechanisms, etc) and, therefore, improving farm production efficiency would, in turn, lead to a stronger production base of RPO.

(v) *Access to inputs and financial services*

As was assessed by our study, poor access to planting material, agrochemicals and financial capital is one of the major production constraints in the study area. In this respect, development support might consider providing technical assistance to RPOs in setting up facilities (e.g., nurseries, saving cooperatives, fertilizer depots, etc.) that improve access of RPO members to required resources and services. Additionally, RPOs can lower member costs of accessing physical and financial inputs by providing farmers with the required inputs before season (as the case study RPO does). RPOs can use individual sales records as an assurance of repayability of RPO members. (The ways to achieve the required increase of RPO working capital were previously discussed in the paragraph Payment "on the spot".) The proposed measures of facilitating access to inputs could, on the one hand, relax farmer production constraints (i.e., improve productivity) and, on the other hand, make participation in RPO more attractive for farmers and increase the amount of produce sold through RPO. Like Poulton *et al.* (2010), we view RPO as a tool for horizontal farmer coordination that can be used for creating and improving resource and service access linkages of smallholder farmers.

The results of public good games preliminarily confirm the relationship between member willingness to contribute to the common pool and the amount of produce they sell through the RPO. Specifically, the game results show that the diversity of member contributions (measured as standard deviation) is negatively correlated with the amount of sales through RPO, which means that the more heterogeneous the willingness to contribute is among group members, the less is sold through the group. The outcomes of the games indicate that the structure and internal composition of farmer groups influence their performance as a group. However, this result is preliminary and yet to be tested with a sufficiently large sample. It would be interesting to inspect the relationship between member contributions in public goods games and RPO sales statistics, in particular the relationship between individual game contributions and individual decision on which share of produce to sell through the RPO, once more sample data are available.

(b) *Limitations of the study*

As our in-depth assessment of RPOs was mainly based on one case study, its results might therefore be biased toward this particular case. Hence, when generalizing from the results, one has to consider the specifics of the RPO in this case study. There are two features to be aware of: The first is that coffee is a high value-durable commodity. Organizations dealing with other products, such as staple crops, perishable crops or dairy and livestock products may differ significantly from the researched RPO (Markelova & Mwangi, 2010). The second is that Kibinge has relatively good (for a rural area in Uganda) market access and rural infrastructure. The situation in more remote areas of the country (especially on the North) is probably different. Thus, we consider our results most valid for coffee-specialized RPO in development domains with rather good market access and infrastructure (Ruecker *et al.*, 2003).

Our Net-Map sessions and the IFPRI (2010) survey included only current members of RPO, and former members or non-members were not approached. Still, farmers who decided not to join or leave the RPO may provide valuable insights into the perceived problems and RPO benefits. Moreover, the self-assessment results are likely to be subject to a confirmation bias (i.e., members of RPO psychologically would like to think that the membership is beneficial for them). Also, in order to keep the discussions within the reasonable time limits, we mostly gathered information on the current state of established RPO. But, as recent results of Ragasa and Golan (2014) suggest, the foundation for the good performance of RPO could be already laid at the stage of RPO formation. Thus, our practical recommendations are more applicable for already established RPO, and not for RPO in formation.

The social and political functions of RPO, for example political empowerment, building social networks, or the organization of community services, were not assessed in our case study. Yet, these functions of RPO are important and well recognized (Bernard *et al.*, 2008; Bosc *et al.*, 2002), as they result in empowerment of rural communities and improve rural livelihoods.

In addition, the small sample size of the public goods games might have undermined the statistical reliability and representativeness of the respective results. The results of the public goods games are provided in this paper for preliminary testing of the stated hypothesis, as well as for demonstration of the developed methodological toolbox.

(c) *Questions for future research*

In this paper we identified the areas in which measures of RPO support are likely to be beneficial for the RPO and its members. However, quantitative assessments are required in order to design practical interventions that would also be economically efficient. Currently we are working on adapting the bioeconomic simulation software MPMAS (Schreinemachers & Berger, 2011) for simulating the functioning of RPOs in Uganda. With this software we are conducting *ex ante* assessments of various development interventions for RPO (Latynskiy & Berger, 2015).

As yet, research efforts in the field of RPO are limited to case studies (Ragasa & Golan, 2014). Depending on the local specifics, these case studies (Bernard *et al*., 2008; Bernard & Spielman, 2009; Bernard & Taffesse, 2012; Chibanda *et al*., 2009; Shiferaw *et al*., 2008) present varied evidence and come to different conclusions. Therefore, a broader cross-country analysis is needed to identify the political, legal and socioeconomic environments in which RPOs are likely to succeed. Also, studies have to reveal which of the many existing types of RPO are the most effective in different environments. Moreover, the appropriate mechanism for provision of support to RPO on a large scale is yet to be found. More research is needed for the evaluation of various types of institutional frameworks (public and private) with regard to their ability to assist the formation, functioning, and securing the sustainability of RPO.

It is also important to understand the trajectories that the recently formed African RPOs may go through. Analyzing histories of existing and defunct RPO will reveal problems and barriers that the RPOs are facing at the various stages of their organizational lifecycle (i.e., formation, establishment, maturity, etc) and assess the impact of providing external assistance at these stages.

6. CONCLUSION AND OUTLOOK

The mix of various research methods (survey analysis, Net-Map, group discussions, key informant interviews and public goods games) applied in the described study highlighted different aspects of RPOs in Uganda and provided different perspectives for the analysis. Combining several research methods helped in understanding the functioning of RPOs and the problems they face. Visualization of stakeholder-provided information by means of collaborative mapping facilitated stakeholder involvement and improved the quality of the dialog between the respondents and the researchers. The application of the Net-Map tool, which is inexpensive and easy to use, was clearly beneficial for the research.

The growing involvement of Ugandan farmers in agricultural RPOs draws a clear perspective for using RPO as (i) tools for improvement of farmer commercialization and access to output markets, (ii) conduits for diffusion of good agricultural practices and (iii) providers of resources for farms in rural areas. RPOs are already making progress in these directions. However, they are confronted with several limitations caused by insufficient capital endowment, weak information channels inside the organization, problems with local leadership and low member contributions. The role of development assistance and extension services, therefore, lies in helping RPOs to find solutions to these problems. Appropriate mechanisms of support are yet to be found and researched.

In follow-up research, we use the results of this study to parameterize bioeconomic simulation models of RPO (Latynskiy & Berger, 2015). The study results inform this modeling effort in several ways: (i) the network maps help to conceptualize the model, (ii) survey statistics, discussions with RPO members and key informants provide some of the model parameters and (iii) outlined intervention areas are considered during the set-up of simulation experiments. Prospective modeling results are expected to identify effective and cost-efficient development interventions that support RPO.

NOTES

1. 1US dollar = 2,494 Ugandan shillings in 2011 (Source: www.oanda.com).

REFERENCES

Akwabi-Ameyaw, K. (1997). Producer cooperative resettlement projects in Zimbabwe: Lessons from a failed agricultural development strategy. *World Development, 25*(3), 437–456. http://dx.doi.org/10.1016/S0305-750X(96)00106-4.

Arcand, J. -L. (2002). *Producer organizations in Burkina Faso and Senegal: A synthesis of case studies in twenty villages*. CERDI-CNRS. Working paper.

Baffes, J. (2006). Restructuring Uganda's coffee industry: Why going back to basics matters. *Development Policy Review, 24*(4), 413–436. http://dx.doi.org/10.1111/j.1467-7679.2006.00332.x.

Bernard, T., Collion, M.-H., de Janvry, A., Rondot, P., & Sadoulet, E. (2008). Do village organizations make a difference in African rural development? A study for Senegal and Burkina Faso. *World Development, 36*(11), 2188–2204. http://dx.doi.org/10.1016/j.worlddev.2007.10.010.

Bernard, T., & Spielman, D. J. (2009). Reaching the rural poor through rural producer organizations? A study of agricultural marketing cooperatives in Ethiopia. *Food Policy, 34*(1), 60–69. http://dx.doi.org/10.1016/j.foodpol.2008.08.001.

Bernard, T., & Taffesse, A. S. (2012). Returns to scope? Smallholders' commercialisation through multipurpose cooperatives in Ethiopia. *Journal of African Economies, 21*(3), 440–464. http://dx.doi.org/10.1093/jae/ejs002.

Bosc, P.-M., Eychenne, D., Hussein, K., Losch, B., Mercoiret, M.-R., Rondot, P., *et al.* (2002). *The role of rural producer in the World Bank development strategy*. Washington, DC: The World Bank.

BOU. (2013). *Annual report 2012/2013*. Kampala, Uganda: Bank of Uganda.

Chibanda, M., Ortmann, G., & Lyne, M. (2009). Institutional and governance factors influencing the performance of selected smallholder agricultural cooperatives in KwaZulu-Natal. *Agrekon, 48*(3). http://dx.doi.org/10.1080/03031853.2009.9523828.

Dejene-Aredo, S., Hill, R., Keefe, M., Maruyama, E., & Viceisza, A. (2009). *Uganda focus group notes*. Kampala, Uganda: International Food Policy Research Institute.

Evenson, R. E., & Gollin, D. (2003). Assessing the impact of the Green Revolution, 1960 to 2000. *Science, 300*(5620), 758–762. http://dx.doi.org/10.1126/science.1078710.

FAOSTAT (2014). Food and Agriculture Organization of United Nations. Statistics division. *Online database*. Retrieved from <faostat.fao.org>.

Fischer, E., & Qaim, M. (2012). Gender, agricultural commercialization, and collective action in Kenya. *Food Security, 4*(3), 441–453. http://dx.doi.org/10.1007/s12571-012-0199-7.

Gabre-Madhin, E. Z. (2001). Market institutions, transaction costs, and social capital in the Ethiopian grain market. *Research Report of the International Food Policy Research Institute, 124*, 1–93.

Hazell, P. (2005). Is there a future for small farms?. *Agricultural Economics, 32*(1), 93–101. http://dx.doi.org/10.1111/j.0169-5150.2004.00016.x.

Hazell, P., Poulton, C., Wiggins, S., & Dorward, A. (2010). The future of small farms: Trajectories and policy priorities. *World Development, 38*(10), 1349–1361. http://dx.doi.org/10.1016/j.worlddev.2009.06.012.

Hill, R. V. (2010). Liberalisation and producer price risk: Examining subjective expectations in the Ugandan coffee market. *Journal of African Economies, 19*(4), 433–458. http://dx.doi.org/10.1093/jae/ejq010.

Holden, S. T., Shiferaw, B., & Wik, M. (1998). Poverty, market imperfections and time preferences: Of relevance for environmental policy?. *Environment and Development Economics, 3*(1), 105–130.

ICO. (2014). International Coffee Organization. *Country datasheets*. Retrieved from <www.ico.org>.

IFAD (2001). *Rural poverty report 2001: The challenge of ending rural poverty*. New York, NY: Oxford University Press.

IFAD. (2010). *Rural poverty report 2011: New realities, new challenges: new opportunities for tomorrow's generation*. Rome, Italy: Quintily.

IFPRI. (2010). International Food Policy Research Institute. *Strengthening Rural Producer Organizations: Working together for market access project. Uganda baseline survey*.

Kasozi, A. (2008). *The role and influence of institutions in economic development in Uganda: Evidence and insights from the development of the Uganda coffee sector: 1900–2004* (Ph.D. thesis). University of Hertfordshire.

Key, N., Sadoulet, E., & De Janvry, A. (2000). Transactions costs and agricultural household supply response. *American Journal of Agricultural Economics, 82*(2), 245–259. http://dx.doi.org/10.1111/0002-9092.00022.

Kwapong, N. A., & Korugyendo, P. L. (2010). Revival of agricultural cooperatives in Uganda. *Uganda Strategy Support Program (USSP)*. Policy note no. 10.

Latynskiy, E., & Berger, T. (2015). UTZ certification for groups of smallholder coffee farmers: Hype of hope?. In *Contributed paper at 29th International Conference of Agricultural Economists (ICAE), 9th–15th of August 2015*. Italy: Milan.

Markelova, H., Meinzen-Dick, R., Hellin, J., & Dohrn, S. (2009). Collective action for smallholder market access. *Food Policy, 34*(1), 1–7. http://dx.doi.org/10.1016/j.foodpol.2008.10.001.

Markelova, H., & Mwangi, E. (2010). Collective action for smallholder market access: Evidence and implications for Africa. *Review of Policy Research, 27*(5). http://dx.doi.org/10.1111/j.1541-1338.2010.00462.x.

Masiga, M., & Ruhweza, A. (2007). *Commodity revenue management: Coffee and cotton in Uganda*. Winnipeg, Manitoba, Canada: International Institute for Sustainable Development.

Miiro, R. F., Mazur, R. E., & Matsiko, F. B. (2012). Factors in the transfer of governance-facilitation skills within farmers' marketing organizations in Uganda. *Journal of Agricultural Education and Extension, 18*(3), 231–245. http://dx.doi.org/10.1080/1389224X.2012.670051.

Mrema, H. (2008). Uganda: Starting all over again. In P. Develtere, I. Pollet, & F. Wanyama (Eds.), *Cooperating out of poverty. The renaissance of the African cooperative movement*. Geneva: International Labour Office.

Musoli, P., Hakiza, G., Birikunzira, J., Kibirige-Sebunya, I., & Kucel, P. (2001). Coffee. In J. Mukiibi (Ed.), *Agriculture in Uganda. Crops* (Vol. II). Kampala, Uganda: Fountain Publishers Ltd.

Nilsson, J. (2001). Organisational principles for co-operative firms. *Scandinavian Journal of Management, 17*(3), 329–356. http://dx.doi.org/10.1016/S0956-5221(01)00010-0.

Poulton, C., Dorward, A., & Kydd, J. (2010). The future of small farms: New directions for services, institutions, and intermediation. *World Development, 38*(10), 1413–1428. http://dx.doi.org/10.1016/j.worlddev.2009.06.009.

Raabe, K., Birner, R., Sekher, M., Gayathridevi, K., Shilpi, A., & Schiffer, E. (2010). *How to overcome the governance challenges of implementing NREGA*. IFPRI discussion paper, 00963.

Ragasa, C., & Golan, J. (2014). The role of rural producer organizations for agricultural service provision in fragile states. *Agricultural Economics, 45*(5). http://dx.doi.org/10.1111/agec.12105.

Ruecker, G., Park, S., Ssali, H., & Pender, J. (2003). *Strategic targeting of development policies to a complex region: A GIS-based stratification applied to Uganda*. ZEF discussion papers on development policy.

Schiffer, E. (2007). *Net-Map Toolbox. Influence mapping of social networks. Manual*. Washington, DC: International Food Policy Research Institute.

Schiffer, E. (2013). *Net-Map Toolbox. Influence mapping of social networks*. Website. Retrieved from <netmap.wordpress.com>

Schiffer, E., & Hauck, J. (2010). Net-Map: Collecting social network data and facilitating network learning through participatory influence network mapping. *Field Methods, 22*(3), 231–249. http://dx.doi.org/10.1177/1525822X10374798.

Schreinemachers, P., & Berger, T. (2011). An agent-based simulation model of human–environment interactions in agricultural systems. *Environmental Modelling and Software, 26*(7), 845–859. http://dx.doi.org/10.1016/j.envsoft.2011.02.004.

Shiferaw, B., Hellin, J., & Muricho, G. (2011). Improving market access and agricultural productivity growth in Africa: What role for producer organizations and collective action institutions?. *Food Security, 3*(4), 475–489. http://dx.doi.org/10.1007/s12571-011-0153-0.

Shiferaw, B., Obare, G., & Muricho, G. (2008). Rural market imperfections and the role of institutions in collective action to improve markets for the poor. *Natural Resources Forum, 32*(1), 25–38. http://dx.doi.org/10.1111/j.1477-8947.2008.00167.x.

UCDA. (2013). Uganda Coffee Development Authority. Website. Retrieved from <http://www.ugandacoffee.org>.

UCTF. (2013). Uganda Coffee Trade Federation. Website. Retrieved from <http://www.ugandacoffeetrade.com>.

UCTF (2010). In B. Namwagala (Ed.), *Coffee yearbook 2009/2010*. Kampala, Uganda: Uganda Coffee Trade Federation.

Uphoff, N. (1993). Grassroots organizations and NGOs in rural development: Opportunities with diminishing states and expanding markets. *World Development, 21*(4), 607–622. http://dx.doi.org/10.1016/0305-750X(93)90113-N.

Van Asten, P., Wairegi, L., Mukasa, D., & Uringi, N. (2011). Agronomic and economic benefits of coffee–banana intercropping in Uganda's smallholder farming systems. *Agricultural Systems, 104*(4), 326–334. http://dx.doi.org/10.1016/j.agsy.2010.12.004.

Wanyama, F. (2008). The invisible, but resilient African cooperatives: Some concluding remarks. In P. Develtere, I. Pollet, & F. Wanyama (Eds.), *Cooperating out of poverty. The renaissance of the African cooperative movement*. Geneva: International Labour Office, World Bank Institute.

World Bank (2007). *World development report 2008. Agriculture for development*. Washington, DC: The World Bank.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.worlddev.2015.10.014.