Out-scaling and up-scaling orange fleshed sweetpotato technologies: the potential role of innovation platforms

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An innovation systems (IS) perspective is increasingly being used as an organising framework to support the application of research knowledge for desired socio-economic outcomes. The IS approach recognises that a broad participation and interaction of actors from public and private sectors is required for agricultural innovation to take place. This approach builds on a wide range of existing participatory technology development and transfer approaches. Under the Dissemination of New Agricultural Technology in Africa (DONATA), Orange Fleshed Sweetpotato (OFSP) project, Innovation Platforms for Technology Adoption (IPTAs) are being formed in Ethiopia, Kenya, Rwanda, Tanzania and Uganda. These aim to bring together relevant value chain stakeholders to develop institutional mechanisms that will support the up-scaling of OFSP technologies (e.g. new varieties, agronomic practices, and post-harvest activities). The paper presents results from a literature review illustrating current thinking in a number of areas including: how partnerships established to support agricultural innovation contribute to emerging typologies and theoretical frameworks for partnership research; how partnerships instigate institutional changes conducive to creating a space for innovation through increased interaction and social learning; what competencies and capacities are required for a partnership to contribute to innovation; and, how the bio-physical characteristics of OFSP might influence the type of partnership and institutional changes required to up-scale benefits to small-scale farmers. These results will be used to contribute to a design framework for a series of action research case studies to capture lessons on the experiences from the innovation platforms on up scaling OFSP.

Keywords: Partnerships Innovation Systems Orange-fleshed Sweetpotato East and Central Africa.

Introduction

Recent work across East and Central Africa (ECA) has shown that beta-carotene rich orange fleshed sweetpotato (OFSP) varieties with high dry matter content are acceptable to consumers (Anderson*, et al.*, 2007; Andrade*, et al.*, 2009; Mwanga*, et al.*, 2009). Positive agronomic characteristics include: short maturation period, low labour requirements, and reliable yields under low input, marginal conditions. It is acknowledged that continued work is needed on breeding for disease resistance and drought tolerance. However, to date, less consideration has been directed towards understanding the institutional arrangements required to support the adaptive uptake and sustained up-scaling of OFSP which could contribute towards improved socio-economic benefit for small scale farmers. This requires research to gain a clearer understanding of whether and how multi-stakeholder partnerships can contribute to on-going technological, institutional and social innovations in different contexts.

Over the last 10 years there have been a number of initiatives to apply innovation systems theory to the institutional arrangements for agricultural research and development in developing countries. The agricultural innovation systems approach builds on earlier approaches for strengthening farmer participation and farmer organization, but also seeks to create linkages among a broader range of stakeholders within and beyond the agricultural sector. This is in part a reaction to the failure of the linear model of technology transfer (i.e. from researcher to extension agent to farmer) to deliver sustained and wide-spread benefits from research outputs to farmers. Interest in applying an innovation systems approach is also a reflection of the increasing complexity of agricultural research in a market driven global economy.

Under the Dissemination of New Agricultural Technology in Africa (DONATA), Orange Fleshed Sweetpotato (OFSP) project, Innovation Platforms for Technology Adoption (IPTAs) are being formed in Ethiopia, Kenya, Rwanda, Tanzania and Uganda. The IPTAs aim to bring together relevant value chain stakeholders to develop institutional mechanisms that will support the up-scaling of OFSP technologies (e.g. new varieties, agronomic practices, and post-harvest activities).

Objectives

The paper presents findings from a preliminary literature review to illustrate current thinking in the following areas:

1. how an analysis of partnerships established to support agricultural innovation can contribute to emerging typologies and theoretical frameworks for partnership research;
2. what types of partnership practices instigate institutional changes conducive to creating a space for innovation;
3. what competencies and capacities are required for a partnership to contribute to innovation;
4. how do the bio-physical characteristics of OFSP influence the type of partnerships and institutional changes required to out and up scale benefits to small-scale farmers.

Methods

This paper has drawn considerably from the bibliography compiled by Horton et. al. for their working paper for the International Potato Center (CIP): "Perspectives on Partnership: A Review of Literature Relevant to International Agricultural Research for Development" (Horton*, et al.*, in press). Their review has provided extensive coverage of different literatures on partnerships. The paper has also been fortunate to benefit from two recent workshops focusing on agricultural innovation. These were: "Innovation Africa: Enriching Farmers' Livelihoods" held in Kampala, Uganda in late 2006, (Sanginga*, et al.*, 2009); and "Farmer First Revisited: Innovation for Agricultural Research and Development", held in Brighton, England at the end of 2007 (Scoones and Thompson, 2009). The web-based materials and published books resulting from these workshops illustrate the current state of the art as well as emerging issues and concerns about the application of an innovation systems approach to partnerships for agricultural research and development. Additional materials were identified through web-based searches using the following key words: *innovation systems, agricultural innovation systems, innovation platforms*. The literature on partnerships and innovation is vast and covers different disciplines. This has led to difficulties in defining boundaries for the review. In this review the following definitions have been used:

1. *Innovation* is the first significant use of new ideas, new technologies or new ways of doing things in a place or by people where they have not been used before (Research-into-Use, 2008).
2. *Out-scaling* is the 'horizontal' spread of knowledge and adaptive uptake of technologies, processes and practices (e.g. to farmers or businesses at a similar level) (Research-into-Use, 2008).
3. *Up-scaling* is influencing decision makers at a 'higher' level to develop policies which provide a more enabling environment for 'scaling-out' [significantly increase the understanding of how the promotion and widespread use of particular research-based knowledge can contribute to poverty reduction and economic growth] (Research-into-Use, 2008).
4. *Institutions* are the sets of common habits, routines, practices, rules or laws that regulate the relationships and interactions between individuals and groups (Hall*, et al.*, 2005a).
5. *Organizations* are bodies such as enterprises, research institutes, farmer cooperatives and governmental or non-governmental organizations (NGOs) (Hall*, et al.*, 2005a).

The current review should be considered as work in progress to contribute to a theoretical framework and develop hypotheses to assess the contribution of different types of partnership models (e.g. the DONATA innovation platforms for technology adoption) to support innovation processes for the adaptive up-scaling of technologies. The paper is organized to discuss the findings for each objective in turn.

Results

Horton et. al. (in press) have conducted an expansive and illuminating review of the partnership literature for agricultural research and development. This assessed the current state of knowledge on partnerships and analysed how an improved understanding of the way in which partnerships function can also contribute to

international agricultural research and development. The authors identified a number of professional literatures where partnerships have been studied for their contribution to agricultural research and development. They argued that these literatures have evolved in relative isolation from one another. This has therefore led to a situation where there is no broadly accepted theoretical framework through which to analyze the role and value of partnerships in different contexts.

Horton et. al. found that there has been limited empirical field work to test theoretical models on different partnering arrangements. They identified a range of issues that required further research for different levels of partnerships. These included:

1. which factors influence the performance of different types of innovation partnerships associated with CG centers and programs;
2. how partnerships are constructed by participating actors and how they are negotiated in practice;
3. how partnerships perform in terms of outcomes and value added, and evidence that despite high transaction costs working in partnership does add value.

How can an innovation systems perspective contribute to a typology and framework for partnership research

An innovation system has been defined as a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behavior and performance. The innovation systems concept embraces not only the science suppliers but the totality and interaction of actors involved in innovation. It extends beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in novel and useful ways (World Bank, 2006).

The innovation systems framework developed by Arnold and Bell in 2001 (World Bank, 2006), focuses on six major domains. The first three consist of: the demand domain comprising producers (e.g. farmers) and consumers who are crucial as sources of innovation and in guiding the direction of innovation; the education and research domain, and the business and enterprise domain. These are linked by a fourth domain which consists of the intermediate or bridging organizations that support the flow of knowledge between the other domains. The final two domains incorporate infrastructure related elements (e.g. banking and business support systems) and the external environment which provides the enabling conditions and incentives for innovation.

A key feature of an innovation system is the interaction among a range of actors which can be from public and private sectors, and civil society organizations. The actual actors and their functions depend on the context, drivers, and goal of the innovation system. There may be different drivers of the innovation system. These have been divided into market and non-market drivers. An agricultural product value chain (APVC) is an example of a market driven innovation process where the actors interact through the market. However, a market driven innovation system may not necessarily have as its goal to benefit small-scale farmers or have a pro-poor impact. Kaplinsky and Morris argue that in the context of globalization and the disjuncture between market integration versus the extent to which people gain, value chain analysis can identify where up-grading may have the most pro-poor impact. (Kaplinsky and Morris, 2000) The Participatory Market Chain Approach (PMCA) (Bernet*, et al.*, 2006) is one pro-poor value chain approach which differentiates itself from other approaches by its focus on stimulating innovation and long term partnerships among farmers, market agents and service providers. In this way it emphasizes the importance of social capital formation. Hall et al. have also pointed out that the market alone is not sufficient to promote interactions for innovation and that the public sector and or intermediary organizations have a critical role to play (Hall*, et al.*, 2005a). Non-market drivers of innovation may include policy changes or incentives, access to information, finance, collective actions, and social demand in addition to availability of technology.

The World Bank has argued that an innovations systems approach and a value chain approach are complementary in that the innovation system perspective provides a way of planning how to create and apply new knowledge required for the development, adaptation, and future profitability of the value chain (World Bank, 2006). A value chain approach provides the context for analyzing opportunities for innovation; however it may focus more on market actors and the productive sector. If the value chain is conceptualized as the business and enterprise domain and part of a broader innovation system there can be linkages and knowledge flows

through intermediaries to the other domains to influence macro economic factors, and the political economy. One implication for partnership research is to understand how a partnership is able to operate across different scales.

Devaux et al. have built on earlier work by Ostrom, Agrawal and the World Bank to propose a framework which integrates market chain and innovation systems concepts (Devaux*, et al.*, 2009). They propose an innovation arena which focuses on social processes of learning and the formation of social capital. The innovation arena is influenced by four sets of exogenous variables that influence the emergence and outcomes of collective action in market chain innovation. These are the external environment, biophysical and material characteristics of the market chain, characteristics of the market chain actors and institutional arrangements. The framework is reproduced below to illustrate these theoretical interactions. Horton et. al. have proposed to adapt this framework for assessing the performance of partnerships (Horton*, et al.*, in press).

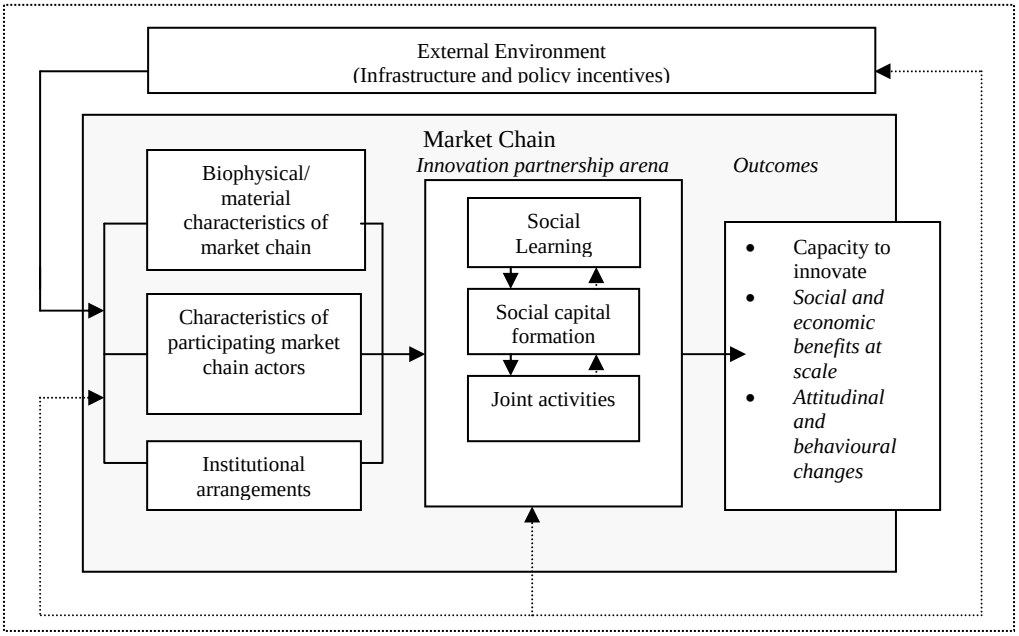

Figure 1. Framework for analyzing innovation partnerships. (Adapted from Devaux et al.)

A number of innovation systems characteristics can be analyzed to understand how partnership processes might work in support of specific socio-economic outcomes (Devaux*, et al.*, 2009; Spielman*, et al.*, 2009; World Bank, 2006). These characteristics are grouped as follows:

1. The patterns of interaction among partners based on their roles and the specific nature of the sub-sector that they are working in;
2. The social processes of learning which contribute to flows of information among partners, changes in attitudes and capacity for innovation;
3. The "framework conditions" or external environment that influences and is influenced by innovation processes;
4. The institutional arrangements for the innovation system to manage its internal and external interactions.

In the context of applying the framework to monitor the evolution and potential added value of innovation platforms as a partnership model, it is also proposed to refine it in the following ways: to emphasize the role of

innovation *partnerships* and to show that the outcomes of the innovation process should demonstrate impacts related to *attitude and behaviour change; and up-scaling improved socio-economic outcomes.*

Therefore an innovation systems perspective can contribute to partnership research by providing an explicit theoretical framework as a basis to analyze the types of actors involved in a partnership, their interactions and the drivers or sources of the innovation process. This framework also emphasizes how a partnership in support of innovation processes needs to span different scales so that sub-sector value chain activities can be linked to the infrastructure, policy and institutional context for up-scaling.

What types of partnership practices instigate institutional changes conducive to creating a space for innovation?

Building on earlier work within the agricultural knowledge information systems (AKIS) framework, an innovation systems perspective brings in not only a greater heterogeneity of actors from beyond the public sector, but emphasizes the importance of interaction, potential synergies and knowledge exchange among those actors for innovation to take place (Röling, 2009). This highlights the importance of identifying mechanisms for knowledge management (i.e. the generation, capturing, codifying, sharing and utilisation of knowledge) to support social processes of learning and interaction as part of partnership practice.

As Hall has commented it is not clear the extent to which the interactions and social processes for learning are ad-hoc or require to be facilitated through a specific mechanism and learning tools (Hall*, et al.*, 2004). The potential practices and mechanisms depend on the level or levels that the partnership is working at, the type of partners and partners' organisational, social and cultural attitudes towards knowledge sharing and learning.

One approach that has been tried at a meso and national level is to establish "learning alliances" or "knowledge sharing platforms" to support out-scaling and up-scaling of innovations arising from project research (Fenta and Assefa, 2009). These generally have the aim of bringing together a range of stakeholders interested in innovation and the creation of new knowledge in an area of common interest. These types of mechanisms are particularly useful for linking into broader networks and when advocating for the policy and institutional changes required for further up-scaling of technologies. Another approach is to promote "communities of practice" which are groups of people who share a passion for something that they know how to do and who interact regularly to learn how to do it better (Wenger, 2002).

At the micro or local level Spielman et. al comment that a key constraint to effective innovation capacity among small-scale farmers is their inability to integrate and navigate within such knowledge and learning alliances or networks so that they are able to access technical and commercial information, markets and financing (Spielman*, et al.*, 2009). Tacit knowledge is held by farmers and in cultures with a rich oral tradition, face-to-face exchange remains central to formal and informal learning processes. The spread of cell phone use and application in the agriculture sector for dissemination of market prices shows that information and communication technology (ICT) technologies can spread quickly if appropriate, available and affordable. With increasing internet connectivity, Web 2.0 and social media tools also offer greater opportunity to tap into existing and emerging knowledge. Therefore partnership practice needs to find ways to bridge knowledge management processes across the micro-meso-macro levels as well as balance the increasing availability of ICT with social and institutional processes. Farmer Organizations (FOs) within a partnership may be well placed to develop this intermediary and facilitation role if ICT can be appropriately harnessed under low connectivity or limited bandwidth conditions to support their organizational and networking capacity. This would include FOs assessing and consolidating demands for knowledge and skills and negotiating appropriate bi-directional knowledge pathways with farmers.

What competencies and capacities are required for a partnership to contribute to innovation?

The previous sections have briefly examined how an innovation systems approach might contribute to a framework for research on partnerships. They have alluded to different types of capacities required, e.g. knowledge management. The specific technical knowledge and skills required will depend on the sector or commodity focus of the partnership. Knowledge and skills about market functioning and value chain analysis would be needed if a value chain approach is used. Down-stream, a focus on adaptive up-take of technologies, will require skills and experience around participatory approaches, collective action and extension methodologies. Capacities for up-stream activities will require advocacy skills for policy dialogue and for making linkages with those decision makers who can affect the policy and institutional change required for further up-

scaling. With the greater range of actors from multiple sectors that the innovation systems approach encourages, these technical skills may be present or able to be drawn in. In addition, with an increase in the types of partners, disciplines and work across multiple levels, there will be high demand for leadership, coordination and facilitation expertise including negotiation, and conflict management and resolution skills (Hall, 2005b).

Working within a partnership involves transaction costs as time is invested in meetings to determine common objectives, and setting the agenda. This requires attitudinal changes at both the individual and partner organisation level, together with an element of risk-taking. As the partnership may be the institutional mechanism to support innovation there is also the need to monitor the partnership process itself through self-assessment and reflection in addition to monitoring progress towards intended outcomes. The coordination/ facilitation function may be taken up by one member within the partnership or lead partner. However, often in partnerships instigated by a research institution, while the technical and research skills may be present the "soft-skill" side is lacking. An additional implication for multi-stakeholder partnerships are the changes in administrative and financial systems and accountability mechanisms required to channel funds and manage reporting requirements. This may become more difficult when each partner has its own systems.

The use of an innovation systems framework within partnership development can help to identify what competencies are needed and how they can be strengthened. The framework can provide the basis to develop indicators to monitor how capacity is strengthened (Daane*, et al.*, 2009; Spielman and Birner, 2008). These need to assess whether capacity for innovation is sustained beyond the original trigger for the partnership formation. It is also important to understand whether capacities at the individual level within a partnership can also influence the partner's own organisation to support new and more effective partnerships and capacities for innovation in other contexts.

How do the bio-physical characteristics of OFSP as a traded commodity in the market chain influence the type of partnership and institutional changes required to up-scale benefits to small-scale farmers

Innovation processes will reflect both the local socio-economic context and the characteristics of the targeted commodity. Therefore an understanding of the characteristics of orange-fleshed sweetpotato, together with consumer perceptions and preferences are necessary to identify opportunities for up-grading the value chain and the type of partnership needed to support innovation.

In many countries in East and Central Africa sweetpotato is considered as a subsistence, or "orphan" crop. It is predominantly grown by woman and rarely has priority in the crop planting cycle. Sweetpotato is often perceived as a substitute or "poor person's food" when preferred foods are not available or affordable (Andrade*, et al.*, 2009).

The limited availability of quality virus free planting material at the beginning of the rainy season acts as a brake on increasing planted area and production. This can be attributed to the slow rate of vine reproduction, the perishable nature of the planting material, and difficulties of conserving planting material during the dry season or droughts. Therefore seed distribution mechanisms need to be decentralised and able to make available large amounts of material at key points in the seasonal cycle (e.g. at the beginning of the rains). One opportunity for innovation is mass tissue culture multiplication of disease free material in conjunction with decentralised multiplication and distribution sites. However for seed systems to be commercially viable there needs to be consistent market demand for sweetpotato so that farmers are confident that their investment in clean seed vine will bring commercial benefit.

There are some indications that consumer preferences for sweetpotato could be turned around as there is growing awareness of the nutritional properties of OFSP and the role of Vitamin A rich foods in a healthy diet. There are also examples of the potential for product differentiation and value addition at household, community and commercial scale. These include chipping and drying sweetpotato for milling into OFSP flour; use of OFSP flour in baked products such as bread, chapati, mandazi; use of fresh boiled and mashed OFSP for inclusion into baked products, juices; use in poultry feed (Uganda) and by food manufacturing companies (Rwanda) on a commercial scale (Thiele*, et al.*, 2009).

The distance between production and markets or processing centres should be minimal given the perishable and bulky nature of the storage roots (i.e. maximum 7-10 days harvest to consumer). If there is scope for increasing the overall profitability of the OFSP value chain there may be opportunities for potential innovation and farmer organisation for establishing bulking points to reduce collection time, improving storage technologies to increase shelf-life and establishing effective communication mechanisms between producers, transporters, traders and processors (Rees*, et al.*, 2003).

This discussion around the bio-physical characteristics of OFSP illustrates one set of the exogenous factors in the framework proposed by Devaux et al. There may be considerable potential to reduce transaction costs through market chain innovation by focusing on addressing the constraints related to availability of virus free planting materials, conservation of materials during dry periods and the perishable nature of the storage roots. It also points to the need to include and link certain actors along the value chain from the agriculture and health sectors. This would also help to ensure that growth in supply and demand is balanced for consistent market functioning.

Discussion

This brief review has provided a preliminary assessment of the contribution an innovation systems perspective could make to research on partnerships. Moving towards a practical application of an innovation systems approach we can place the OFSP market chain as a sub-system of the broader innovation system. Returning to the framework, we now need to identify the types of institutional arrangements, partnership practices and tools which can support both the interactions required along the market chain, and between the market chain and the broader innovation system which could support further up-scaling. This is discussed in the context of one model for the institutional arrangements for a partnership to support adaptive up-scaling of OFSP technologies – the innovation platform for technology adoption (IPTA).

An innovation platform has been defined as "a network of partners working on a common theme and using research knowledge in ways it has not been used before to generate goods and services that benefit the poor", (Research-into-Use, 2008). Within the DONATA project the IPTA was originally described as a platform comprising researchers, extension or advisory services, civil society organizations in agriculture i.e. farmer organizations, private sector or agri-business, NGOs, policy makers, etc. These would promote the dissemination of high impact agricultural technologies. The platform is described as an annual integrated programme for technology dissemination composed of community selected farmers within a given agro-ecological zone (African Development Fund, 2006). Although the language of an innovation systems approach is alluded to in its name, the theoretical basis for the platform was vague. In addition, the annual time frame was unrealistic and the additional capacities required for the platforms to move beyond a transfer of technology modality were not present. In practice the DONATA IPTAs are emerging in different configurations depending on local country and historical context. This provides an opportunity to use an action research approach to apply an explicit agricultural innovation systems framework in the evolution of the platforms. A number of tools could be tested for their appropriateness in this context. These include, but are not limited to: sub-sector analysis, stakeholder analysis, outcome mapping, and other qualitative tools to assess attitudinal and behaviour change related to partnership practices. The findings from these tools could then contribute to an assessment of the institutional, attitudinal, behavioural capacities and changes needed for the IPTAs to contribute to improved socio-economic outcomes. Therefore, using the framework adapted from Devaux et al. the following hypotheses could be refined and tested:

1. The institutional arrangements for the IPTA should include an explicit mechanism for knowledge management as an incentive for partners to work together on innovation processes.
2. Strengthening the knowledge management capacities of Farmer Organizations can provide a bridge for multi-directional knowledge flows within and across different levels of partnerships.
3. Social processes of learning and interaction among individual partners influence the partners' own organizational learning and institutional changes which could in turn create the more supportive partnership practices and up-scaling of innovations.
4. The IPTA is able to provide an interface for the sub-sector value chain at the local level but is also able to span the other levels necessary to support policy dialogue and influence for scaling up.

Conclusions

This paper has briefly reviewed the agricultural innovation system literature in order to understand how an agricultural innovation systems perspective can contribute to our research on partnerships. An innovation system perspective can contribute to refining definitions of partnerships by emphasizing the importance of multi-sectoral partnerships so that relevant actors fully participate in innovation processes that support the dissemination and use of research outputs. Recent literature has highlighted a number of innovation system characteristics relevant to partnership practice which can be tested to understand whether partnerships for innovation can add value to the adaptive uptake and up-scaling of research outputs. These demand the integration of multiple disciplines, the ability to span multiple levels and to negotiate multiple objectives across the research and development domain. However tested institutional mechanisms to manage these processes efficiently are still lacking.

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