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STRENGTHENING LOCAL SEED SYSTEMS WITHIN THE BEAN VALUE CHAIN: EXPERIENCE OF AGRICULTURAL INNOVATION PLATFORMS IN THE DEMOCRATIC REPUBLIC OF CONGO

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ABSTRACT

Access to good quality seed is the beginning of successful crop production as an enterprise. Unfortunately, this remains a challenge to the smallholder farmers in the eastern and central Africa, whose seed systems are still under-developed. The situation is even worse in conflict burdened parts of some countries like the eastern region of the Democratic Republic of Congo (DRC), where socio-economic systems have been progressively disrupted. This paper presents the process and findings from a study which involved application of an Agricultural Innovation System (AIS) approach to the seed systems to improve the bean (*Phaseolus vulgaris* L.) value chain in South and North Kivu provinces of the DRC. Seventy four stakeholders were involved, including farmers and farmer associations, local grain/seed traders, private and public extension agents, researchers, finance and credit cooperatives and Non-Governmental Organisations (NGOs). The study was conducted in four sites, namely Mudaka and Katana (South Kivu), Rugari and Kinyandonyi (Nord-Kivu). The findings revealed increase in access to seeds of marketable varieties between 2009 and 2012 from less than 10% to about 42%. In 2012 more than 5 tonnes of bean seed was produced and distributed through non-Governmental Organisations (NGOs). About 56.3% of the farmers benefited through accessing one or more of the marketable improved bean varieties and skills to implement matching technologies. The price of bean per tonne at farm level increased by 120%, while seed purity increased from 70 to 95% over the same period. It is evident that innovation platforms provided a good forum for actors in the bean value chain to interact and improve seed system performance, thus resulting in increased smallholder farmers' access to lucrative bean seed markets.

Key Words: Marketable varieties, NGOs, *Phaseolus vulgaris*

RÉSUMÉ

L'accès aux semences de bonne qualité est le début d'une entreprise de production agricole réussie. Malheureusement, ceci reste une contrainte aux petits exploitants agricoles en Afrique de l'Est et Centrale où les systèmes semenciers sont encore peu développés. Cette situation est même aggravée par des conflits dans certaines régions telle l'Est de la République Démocratique du Congo (DR Congo), où les systèmes socioéconomiques ont été progressivement perturbés. Cet article présente le processus et les résultats d'une étude impliquant une approche de Système d'Innovation Agricole des systèmes semenciers pour améliorer la chaine de valeur du haricot (*Phaseolus vulgaris* L.) dans les provinces du sud et nord Kivu de la RDC. Soixante quatorze partenaires étaient impliqués, incluant les fermiers et les associations des fermiers, commerçants locaux des semences, agents de vulgarisation privés et publiques, chercheurs, coopératives de finances et de crédit et Organisation Non-Gouvernementales (ONG). L'étude était conduite dans quatre sites, à savoir, Mudaka et Katana (Sud Kivu), Rugari et Kinyandonyi (Nord-

Kivu). Les résultats ont révélé une augmentation en termes d'accès aux semences de variétés commerçables entre 2009 et 2012 de moins de 10 à environ 42%. En 2012 plus de 5 tonnes de semences de haricots étaient produites et distribuées à travers les ONG. Près de 56.3% des fermiers ont accédé à une ou plusieurs variétés commerçables améliorées et nouvelles connaissances pour exécuter les technologies acquises. Le prix des haricots par tonne au niveau de la ferme a augmenté de 120%, pendant que la pureté des semences a augmenté de 70 à 95% au cours d'une même période. Il est évident que les plates formes d'innovation fournissent un bon forum pour les acteurs dans la chaine de valeur du haricot pour l'interaction et la performance des systemes semenciers, ainsi résultant en une augmentation de l'accessibilité aux marchés lucratifs des semences par les petits exploitants agricoles.

Mots Clés: Variétés commerçables, ONG, *Phaseolus vulgaris*

INTRODUCTION

Access to good quality seed is the beginning of successful crop production initiatives globally. Unfortunately, this remains a formidable challenge to the smallholder farmers in the eastern and central Africa, where seed systems are still under-developed. The situation is even worse in conflict burdened parts of some countries like the eastern region of the Democratic Republic of Congo (DRC), where socio-economic systems have been progressively disrupted.

Eastern DRC, hereafter referred to as Kivu region, experienced a decade of conflict, which resulted in massive displacement of inhabitants, perpetuated poverty and food insecurity because many farms were abandoned and seeds of a wide range of crops were lost. The region's decline in agricultural productivity is basically linked to systemic weaknesses in the country's policies, markets and trade (USAID, 2010).

Although the situation has in some cases led to a growing seed business, most smallholder and resource poor farmers have not been able to benefit from this opportunity due to high costs of production. Farmers in the region mainly obtain seed from informal seed systems, which include farmers-own-saved seeds, seed exchanges among farmers and local seed business (Mastaki, 2006; Njingulula and Kalyabara, 2006). This situation is promoted by a complex and vast process of formal seed sector, whose requirements do not favour smallholder and resource poor farmers (Chirwa and Aggarwal, 2000). This system makes it difficult for the majority of farmers to access and produce quality seed needed for increasing agricultural productivity, and also to participate in the profitable markets (Wanjiku and Birachi, 2011). In DRC, very few seed companies are able to meet the requirements for formal seed production, such as standard seed quality. However, most of these companies have limited trade volumes and, thus are unable to meet the high seed demand in the two provinces of Kivu region (Njingulula, 2012). For example, in 2010 alone, the national bean seed requirement was estimated at over 30,000 against 3,000 metric tonnes which were available (MINAGRI, 2011). As Scott (1995) put it, in spite of a fairly large number of improved varieties released by the research institutes, seeds of these varieties are not easily available to the farmers due to the insufficient efforts made for their multiplication, promotion and distribution.

Although seeds from informal systems are believed to be cheaper, easier to obtain and available in divisible (small) quantities, there are challenges like limited dissemination of improved varieties, use of old and traditional varieties with low productivity. The situation is compounded by limited extension services and lack of access to input and output markets in Kivu region. These results in low, often declining bean yield due to use of poor quality seeds, application of poor agronomic practices and, thus low incomes among rural farmers.

It, therefore, became imperative to provide assistance to farmers, who were emerging out of war, to acquire seeds of improved varieties that would increase production and create surplus for marketing and related businesses to improve households' incomes, since majority of the communities relied on agricultural production for their livelihood. The Agricultural Innovation Approach therefore, was introduced by the National Agricultural Research Institute (INERA) together with other partners (CIAT, PABRA,

FARA and CIALCA) to bolster existing efforts for farmer access to good quality seed and to strengthen this component within the bean value chain of the country. Innovation platforms, which is one of the implementation tools of the Agricultural Innovation Approach, bring together various stakeholders and provide them with a stage to voice their needs. These platforms also provide site-specific solutions to align production with market demands, ensuring better prices for the smallholder producers.

The objective of this study was to strengthen local seed systems in the DRC using innovation platforms (IP) within the bean value chain. This study was conceived on the premise that past relevant initiatives for seed systems in the context of the bean value chain were fragmented, isolated and poorly coordinated and did not produce expected results (USAID, 2010).

Innovation Platform approach. Innovation Platform derives its roots from the innovation systems concept. IP facilitates dialogue between key parties and local players in a value chain; namely farmers and farmer organisations, input dealers, traders, transporters, processors, regulators, and the research and development actors. Innovation Platforms identify constraints and opportunities in production, marketing and the policy environment. The process is galvanised through discussions on important requirements in production, processing and marketing; followed by an analysis of existing strategies. The IP then identifies and implements technologies, innovations and management practices to improve production to fulfil market demand. In a parallel and similar process, the marketing system is analysed and improvements to benefit all role players are tabled and tested within the local context (Edelman, 2003).

The IP presents a dynamic entity with a growing membership that attracts appropriate expertise contingent to the problem being addressed. The central and key partners, often comprise of those with the highest stake. These include seed producers, buyers and users. The IP provides understanding on technology, innovations, management practices and information challenges in seed production and marketing in terms of articulating demands. By bringing together the various stakeholders and providing them with a platform to voice their needs/requirements, the IP generates site-specific solutions to align seed production with users requirements, which will ensure better environments for smallholder seed producers (Hawkins *et al*., 2009).

METHODOLOGY

Study location. The Kivu region is located only two degrees south of the equator. It has three distinctive ecological zones; the central basin, western highlands and the eastern plateau, ranging from 500 to 3, 000 metres above sea level. It has good quality soil for agriculture, supporting a wide variety of food production and industrial activities. The region has two rainy seasons (February–May and September–December) with an annual average rainfall of 1,400 mm, ranging from 1,200 mm in the south-eastern to 2,200 mm in the wet equatorial area. It experiences either mild or tropical climate.

Kivu region has a total surface are of 124,553 km^2 (with North Kivu having 59,483 km^2 and South Kivu 65,070 km^2). Based on DSRP (2000), the region is estimated to have a population of 10,382,713 (with North Kivu having 5,767,945 and density of 71 persons km^{-2} and South Kivu 4,614,768 and density of 97 persons km^{-2}).

The study applied the integrated agriculture research for development (IAR4D) approach, adopted from the Forum for Agricultural Research in Africa (FARA). This approach brings together stakeholders as actors in innovation platforms (FARA, 2011). The study was conducted from 2009 to 2012. A total of 74 participants were randomly selected from Mudaka and Katana in South-Kivu and Rugari and Kinyandonyi in North Kivu. Selection of the locations and participants was based on; the significance of bean production in the area; and being located within INERA Mulungu Research Centre's jurisdiction.

Setting up Innovation Platforms. Setting up of IPs was facilitated by INERA researchers based on FARA IAR4D model (Hawkins *et al.,* 2009). Prior to setting up the IPs, a series of surveys

(Baseline survey and specific survey) and meetings were conducted using focus group discussions and key informant interviews with farmers (both men and women) in the study areas. The surveys were conducted strategically to analyse opportunities and challenges in agricultural productivity in the location, identify commodities, policies, product development and their market chains and to profile the key actors along the value chain in each site. A number of influential farmer groups and traders (men and women), officials, extension agents and NGOs were identified to participate in the inception meeting. During the meeting, 15 participants representing famers, farmers' cooperatives, extension service providers, savings and credit cooperatives, researchers and input dealers and traders) were selected to establish the IP. The actors were selected because they had a stake in the IP based on the identified and quantified output market in relation to the input, advisory services, processing, transportation, agricultural finance and insurance.

The IP process started by selecting a product to be developed as an enterprise, and bean seed was preferred because of its capacity to develop commercially. Training was conducted to develop capacity and understanding of the members of IP process. A market opportunity identification exercise was performed to assess various products viability in terms of agronomic practices, economic and market potential. IP members then developed a work plan with roles of each member on what to do, when and where to meet.

The IPs' meeting intervals depended on issues at hand, usually IP members met at the beginning of the season to plan; then two months later for process monitoring and at the end of the season for evaluation. However, some meetings were held occasionally whenever need arose.

In the IPs, a number of activities were conducted to improve bean productivity and seed production, including training on integrated crop management (ICM), integrated soil fertility management (ISFM) and integrated pest management (IPM) options, use of improved varieties, training on seed and grain differentiation, monoculture and growing of pure and preferred varieties. Improving seed marketing activities such as certification of seed to ensure its quality was done by national seed service. Produced seed was gathered and sold in a group not on individual basis; a marketing committee was formed to promote the product marketing. Members of the IPs from NGOs were responsible to connect farmers to potential buyers, some of which were NGOs themselves and training on business plan, and others marketing strategies among the IP members.

Policy issues were very important, thus the IP process was responsible for improving the policy environment. This was done through involving public officials such as IP members who eventually became advisors. At the same time, other officials' requirements such as acknowledgements were given to IPs.

During implementation of activities in the IPs, a series of meetings and survey were conducted with the objective of enhancing the understanding of key stakeholders' views and experiences with the IP process. Figure 1 represents the IP schematic process.

INERA supplied the initial high quality seed of four released bean varieties, namely CODMLB001, CODMLB059, NUV 178 and NUA 99 for the initial seed multiplication of the bean varieties. These varieties were selected because of their desirable characteristics and tolerance or resistance to important biotic and abiotic constraints.

Bean nurseries were established in each site. Additional training on IAR4D was conducted in each of the established IPs to strengthen capacity of members in IAR4D. Small seed packs of varying sizes (100, 250 and 500 g) were introduced as a follow up on the work done by CIAT in Malawi (Chirwa and Aggarwal, 2000). Simple polythene bags were used and simple labels printed with the name of the variety, were inserted inside each pack.

The technical extension staff also supervised the day-to-day activities; while seed inspectors from National Seed Control Service (SENASEM), periodically inspected seed production activities in the fields. The seed from research systems was multiplied as quality declared seed (QDS) in the farmers' fields. QDS is an intermediary seed category between formal and informal seed.

RESULTS AND DISCUSSION

The trend of IP attendance. There was a rapid increase in the IP participation because of the positive change within the communities where implementation was taking place. Between 2009 and 2012, the membership had increased from 74 (52 male and 22 female) to 1585 farmers (552 men and 1033 women) (Fig. 2), 20 to 45 private sector marketers, 5 to 7 Researchers, 6 to 8 Extension agents and 3 to 4 NGOs. In Kanyandonyi, women's participation in IP meetings and activities was less than 50% in 2009 and improved to 87% in 2012. This increase in women farmers' participation was attributed to increased efforts to mobilise, train and sensitise women for involvement in business and trade as a result of establishing the IPs in this post conflict area.

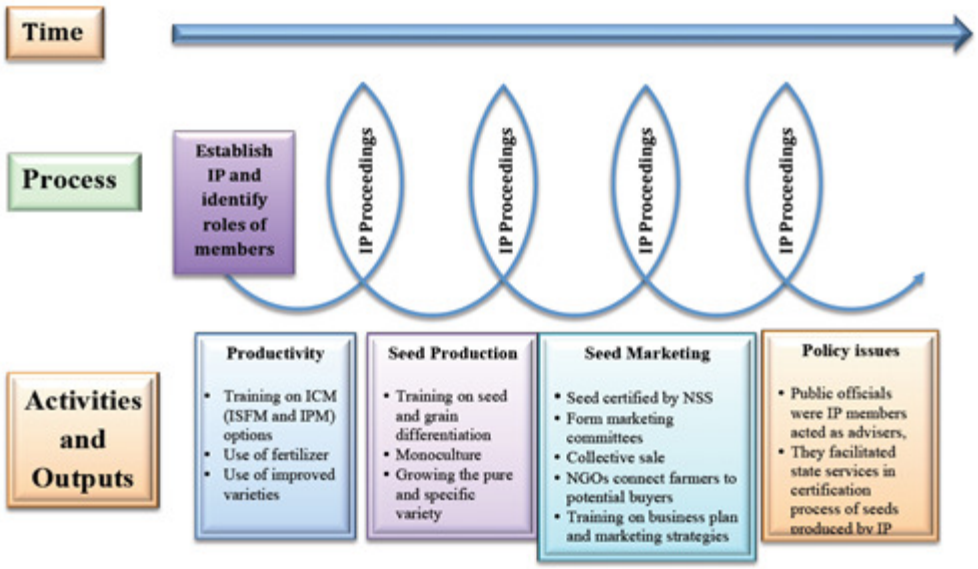

Figure 1. Schematic presentation of the interaction, process and activities in the bean seed value chain Innovation Platform of the Democratic Republic of Congo.

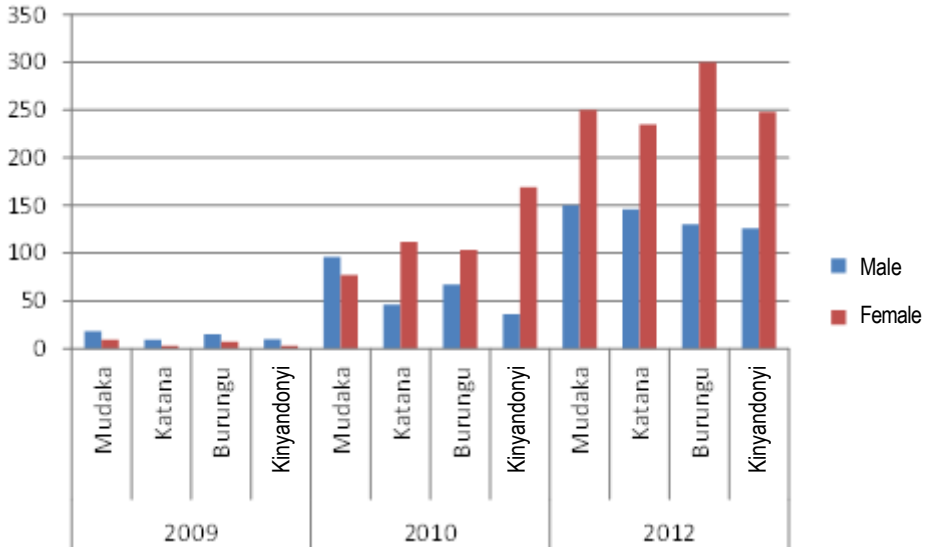

Figure 2. Male and female participation trend in bean seed value chain IP in the Kivu region of the DRC.

Local seed system. The study revealed that most smallholder farmers in the Kivu region were resource poor and had not been able to benefit from formal seed systems, likely due to high cost of production. The farmers got seed from informal seed systems, whereby they selected from their previous crop harvest good grains as seed and preserved them for the next season. This system is known as farmers-own-saved seed system (CIAT, 2000). Seed in this system is often of very poor quality and sometimes contaminated with diseases. Furthermore, several bean varieties are mixed up in the seed lot. On the other hand, where some farmers did not have enough harvest, they obtained the seed from neighbours through farmer-to-farmer seed exchanges and in some cases from local seed businesses. The local seed systems involve grain production, followed by seed selection where the farmers selected good grains for next season and stored them. The diffusion stage (Fig. 3) is where seeds were distributed for sowing. This stage include seed exchange among the farmers and in some cases local seed business.

With establishment of the IPs in the study sites, the seed systems were improved through supply of improved bean seed and varieties from INERA (Fig. 4). This was further enhanced by tailor-made training on integrated crop management technologies and innovations.

Farmers capacity to produce and trade more bean seeds. Farmers' participation in the bean seed IPs enhanced their potential to multiply and market their seeds. The IPs facilitated a close collaboration between smallholder informal seed

Figure 3. Schematic presentation of typical local bean seed system before establishment of Innovation Platforms in the Democratic Republic of Congo.

Figure 4. Schematic presentation of local bean seed system after establishment of the innovation Platforms in the Democratic Republic of Congo.

multipliers, researchers, NGOs, extension agencies, traders and other institutions involved in bean value chain. The IPs received initial seed of four improved bean varieties released by the INERA namely; CODMLB00,CODMLB059, NUV 178 and NUA 99 for multiplication in the study sites. This was intended to increase productivity and provide a surplus for trade. The IPs also enhanced farmers' capacity to adopt and implement the innovations, which were promoted in the platforms. The IPs helped the farmers to improve the quality of the crop produced by ensuring constant supervision of their seed production processes, by both the technical advisory team and SENASEM staff. A number of trainings were conducted to ensure that the seed produced met the desired market standards.

The IPs ensured that the quality-declared-seed (QDS) was disseminated, with priority given to the IPs members; while the rest was supplied to the NGOs who in turn distributed them to farmers in their areas for further multiplication. The seed produced under this arrangement was of better purity than the one from farmer-own-saved seeds As a result of using the value chain approach; the QDS was sold at a price set at15% higher than normal grain market.

In 2012, NGOs involved in the IPs used this arrangement, to purchase and distribute more than 5 metric tonnes of seeds. Through the IPs, the use of small seed packs of 1.0, 0.25 and 1 kg was introduced. This helped small scale and resource poor farmers to access quality seeds of the improved varieties. Through this, more than 3,000 households accessed quality seeds of the new improved bean varieties. However, bulk seed packages were sold to the NGOs and others partners. Basing on bean seed multiplication ratio of 1:10 by Chirwa and Aggarwal (2000), at least 50 metric tonnes of seed were produced by the farmers' associations, who were part of the IPs.

Most small scale farmers in the region commonly engage in informal markets as consumers, often lacking access to improved markets (Barrett, 2008). Engagement in markets by producers is limited because of poor infrastructure, poor inputs and services, high transaction costs and increased risks along the value chain. For example, the fraction of smallholder farmers selling staple grains in the Kivu region is typically between 25-30% (CIALCA, 2010). With regards to seed requirements, smallholders farmers were not permitted to produce and sell certified seed. However, through the IP process, smallholder farmers were transformed from subsistence to small-scale commercial bean farmers. Table 1 presents the evidence of this, where the IP members were able to sell more than 5 tonnes of improved bean seed.

Achievements of the IP approach. A study conducted by INERA (2012) revealed that the IPs played an important intermediary role in stimulating and influencing innovation processes such as shifting from subsistence to commercial bean production. Smallholder farmers benefited in various ways of synergising with others value chain actors. Their involvement in IPs resulted in increased bean yield from 350 to 820 kg ha^{-1}, seed quality improved and increased price for bean producers.

About 46.0% of the farmers reportedly benefited from the association with various actors in bean value chain. A major component of the benefits included improved knowledge in bean production, especially through provision of training. About17.1% of farmers reportedly

TABLE 1. Bean seed production and distribution by IP in 2012 in the Democratic Republic of Congo

Innovation Platform	Quantity distributed to members (kg)	Quantity produced (kg)	Quantity sold (kg)
Mudaka	120	820	500
Katana	360	1340	850
Burungu	830	2350	1300
Kinyandonyi	760	3620	2500
Total	2070	8130	5150

benefited from accessing improved bean varieties; while 11.1% were able to access social support. Other benefits included; access to seed markets, increased incomes and access to credits from financial institutions participating in the IPs, where the NGOs provided the required guarantee or security and many other benefits (Table 2).

About 56.3% of farmers indicated that they easily accessed marketable improved bean varieties and appropriate production techniques. According to INERA (2012), between 2009 and 2012, the bean seed price per metric tonne increased by 120% and seed purity increased from between 70-75 to 95%. It was also observed that farmers responded positively to this process across major bean growing areas of Kivu region.

The study by HarvestPlus (2012) revealed a continuous increase in access to quality seeds (certified, quality declared seed) of both improved and adapted varieties. This resulted in higher adoption of various improved agronomic practices by farmers namely; seed rate, ploughing, timely weeding and judicious use of fertilisers. About 37% of the farmers in the IPs reportedly increased their areas under bean production. Altogether, across the four sites, the area under bean production increased by 34.3%. This was attributed to increased profitability of beans due to increased incentives along the supply chain, increased access to improved bean production packages, and increased awareness of farmers and other supply chain actors. Also, there was increased production and reliable marketing, because several development organisations like NGOs and private sector increasingly mobilised farmers and invested their resources to facilitate farmers to acquire loans, thus improving farmers' livelihoods and helping them in poverty alleviation.

TABLE 2. Opportunities arising from the bean IP membership in the Kivu region of DRC

Opportunities	Percent (n=120)
Improved knowledge on bean production	46.0
Acquired improved bean varieties	17.1
Social support/sharing labour	11.1
Eased marketing of seed	8.0
Income for other necessities	7.3
Source of food/improved nutrition	3.5
Able to access agricultural inputs/support	3.2
Source of credit (capital, seed, equipment)	2.4
Popularity as bean farmers	1.4

Challenges of the IP approach. The IP as a concept requires time for the value chain actors to understand and implement. At the beginning, different actors had different understanding of how the IP operated and had different interests. In order to understand the IP concept, several awareness meetings with stakeholders are required. This is important to ensure that sustainability of the value chain is achieved. The initial meetings have financial implications and require an outsider to be in charge. However, with time the numbers are expected to grow and the costs become too large to be manageable. There has been limited support and mentoring in agro-business, yet it is crucial if the farmers are to transform their farming into commercial and sustainable seed production system. Also, there has been limited flexible mechanisms of building links and local competences so as not to impose models on IPs, but help them to build trust between smallholders and actors in the value chain by developing their competences as the IP process develops.

LESSONS LEARNED

During the study, a number of lessons learnt on the operationalisation of IP were gathered and documented as follows:

(a) The IP plays an intermediary role in facilitating smallholder farmers' involvement in the poverty reduction and food security programme. Farmers who participated in the programme earned more income than those who did not participate. The beneficiaries increased the chances of paying bills such as school fees and feeding of their children

(b) The process of IP revealed that when small-scale farmers are grouped during marketing, they are in a better bargaining position to deal with processors, traders and exporters, due to increased product volumes and reduced transaction costs compared to when

each farmer works independently. The IPs approach also showed that the costs of coordination can be reduced through collective efforts, which are usually limited for individual producers;

(c) Linking smallholder seed producers to value chain has multiplier effects and spreads the benefits of growth across smallholdings system; their linkages with other value chain actors and facilitating institutions can be enhanced. The establishment of IPs and the provision of loan collateral enables resource poor members to access and secure credit from commercial credit providers, who previously were hesitant to lend to farmers.

(d) Whereas the multi-stakeholders' nature of IP is useful, it can be limiting in the sense that the different intermediary actors tend to focus on what seems to be their areas of interest and in some cases this can undermine the broader vision of the programme. For instance, some NGOs worked on the basis of rescue and emergency programmes which distributes free money and input to farmers; while private and governmental services worked on the basis of research and development (R&D) programmes intended to push farmers to invest money so as to acquire agricultural inputs. Therefore, there is need for well-defined and coordinated methods taking into account various areas of interest of different partners; and

(e) Good coordination of actors along the value chain ensured that producers obtain a fair share of the final value. They received a price slightly higher than common grain bean price. Research and NGO involvement in production, processing, and marketing improves the product quality at reasonable prices although the whole sector is owned and managed by farmers.

Sustainability of the IP process. Supply chains that have champions taking the initiative in brokering new arrangements, overseeing changes and resolving problems tend to be more effective and efficient. However, in this particular intervention, the champion was lacking and to fill the gap, the researchers took the lead in bringing together all participants for consultation and further collaboration. The champion could be a dominant processor, wholesaler or exporter with some degree of market power; but it can also be an NGO, government body or donor project. For sustainability of the IP process, it is necessary to identify a champion who will take risks and invest in new arrangements; private sector firms will usually only do this if there is some commensurate reward for the effort, so this will only occur when there is a business opportunity. The challenge is to create conditions that will encourage such initiative, but without allowing the champion to extract undue charges. However, for markets which are contestable, there may be little competition in a market, but there is a credible threat of competitors entering the market that provides a discipline for current participants. The inclusion of the private sector in seed delivery systems is necessary for sustainability, market development, and competitive pricing and product provision.

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