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Innovation Opportunities in Bean Production in the DR Congo

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Abstract

The common bean, *Phaseolus vulgaris,* is the most important pulse food crop for consumption in the world and one of the most important food crops in the DR Congo. Located in Central Africa, DRC is the fourth most populous country in Africa with an estimated population of 75 million in 2015 and the 11th largest country in the world in geographic size. DRC is among the African Great Lakes countries, which have the highest per capita consumption of beans in the world. The purpose of this research is to inform of the potential innovation opportunities in bean production in the DRC. On agronomic aspects, beans are produced in a range of crop systems and environments and require full sun for good growth and yield with sandy loam soils being the best for growth. North Kivu province is important for the production of beans in which the province produced almost 89% of DRC's beans during the 2009-2014 period. Compared with neighboring countries, bean production in the DRC is very low. Nutritionally, beans are a nearly perfect food, providing dietary protein, fiber and complex carbohydrates. However, production of beans in North Kivu and DRC is faced with various constraints including use of poor seed and other inputs, land shortage, and poor handling and storage infrastructure. The VCA conducted at the Maendeleo Bean IP showed that small-holder farmers were the main actors in producing and marketing of beans. Although bean production in the DRC is relatively low, innovation opportunities exist that can upgrade the VC and enhance socio-economic benefits of the VC players. Opportunities for improving bean production will include introducing processing of beans through use of existing mills of other staples and promoting milling of beans into production of bean-based products. These opportunities will entail working with existing organizations for intensified provision of relevant services; extension, financial and business entrepreneur development. These would not only increase income avenues for participating farmers especially women but also increase the range of nutritious products for consumption. With the growing urban and rural populations in the DRC, the identified opportunities are worth exploring.

Key words: DRC, Bean production, agronomy, constraints, VCA, Innovation opportunities

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Introduction

The common bean, *Phaseolus vulgaris L.,* is the most important food legume for direct consumption in the world (FAO, 1999). It is produced in a range of crop systems and environments in diverse regions. In Africa, beans are grown mainly for subsistence and the Great Lakes region has the highest per capita consumption of beans in the world. Beans are a nearly perfect food; nutritionally rich, a good source of dietary protein, folic acid, dietary fiber and complex carbohydrates, and one of the best non-meat sources of iron. When used with maize and rice, their amino acids are complementary. Although common bean is grown for its green leaves, pods, immature and/or dry seeds, the latter are the ultimate economic part of the bean plant. Dry seeds are appreciated throughout the developing world because they have a long storage life, good nutritional properties, and can easily be stored and prepared for eating. For the poor of the world, consumption of beans is high because they are a relatively inexpensive food and therefore a means of keeping malnutrition at bay (FAO, 1999).

The DRC, located in Central Africa, is the fourth most populous country in Africa (after Nigeria, Ethiopia and Egypt) with an estimated population of nearly 75 million in 2015 (DRC NAIP). The population is widely dispersed across the country, 65% living in rural areas and 34.3% living in the country's urban areas (UNDP, 2013). The DRC is a vast nation bordering with nine countries (Congo, the Central African Republic, South Sudan, Uganda, Rwanda, Burundi, Tanzania, Zambia and Angola), and has a combined land and waterway area of 2,344,858 square kilometers (Fig. 1). This makes it the 11th largest country in the world in terms of its geographic size. In spite of its vast size and rank as the continent's fourth most populous nation, the DRC is predominantly under-populated with an average of only 24 inhabitants per square kilometer, with the exception of the capital city of Kinshasa, where the population density in the region is roughly 577 inhabitants per square km. This is not only due to the fact that the city is the national economic hub, the national administrative headquarters and governmental capital, but also due to the rural exodus caused by recurrent conflicts in certain parts of the country and the deterioration of living conditions in rural areas (UNDP, 2013).

DRC is comprised of 11 provinces including North and South Kivu. These two provinces are important for bean production in the DRC (Fig. 1). North Kivu in particular, has an estimated population of 6,655 (3,243 men and 3,412 women) representing nearly 9% of the country's population (INS, 2015). Although seemingly among the least populated compared with the rest of the provinces, North Kivu has among the highest population densities in the country with 97 inhabitants per sq.km (USAID, 2015). This is partly attributed to highly fertile soils which are now quickly degrading due to overuse and poor farming methods. With a favorable average annual rainfall of 1,550mm and temperature ranging from 2-26 degrees C, North Kivu province produces almost 50% of the beans produced in the DRC. However, the country is dealing with the effects of nearly two decades of conflict that contribute to sporadic violence, insecurity, displacement, and political upheaval and continue to impact local economies and livelihoods particularly in the eastern provinces (FEWS NET, 2015).

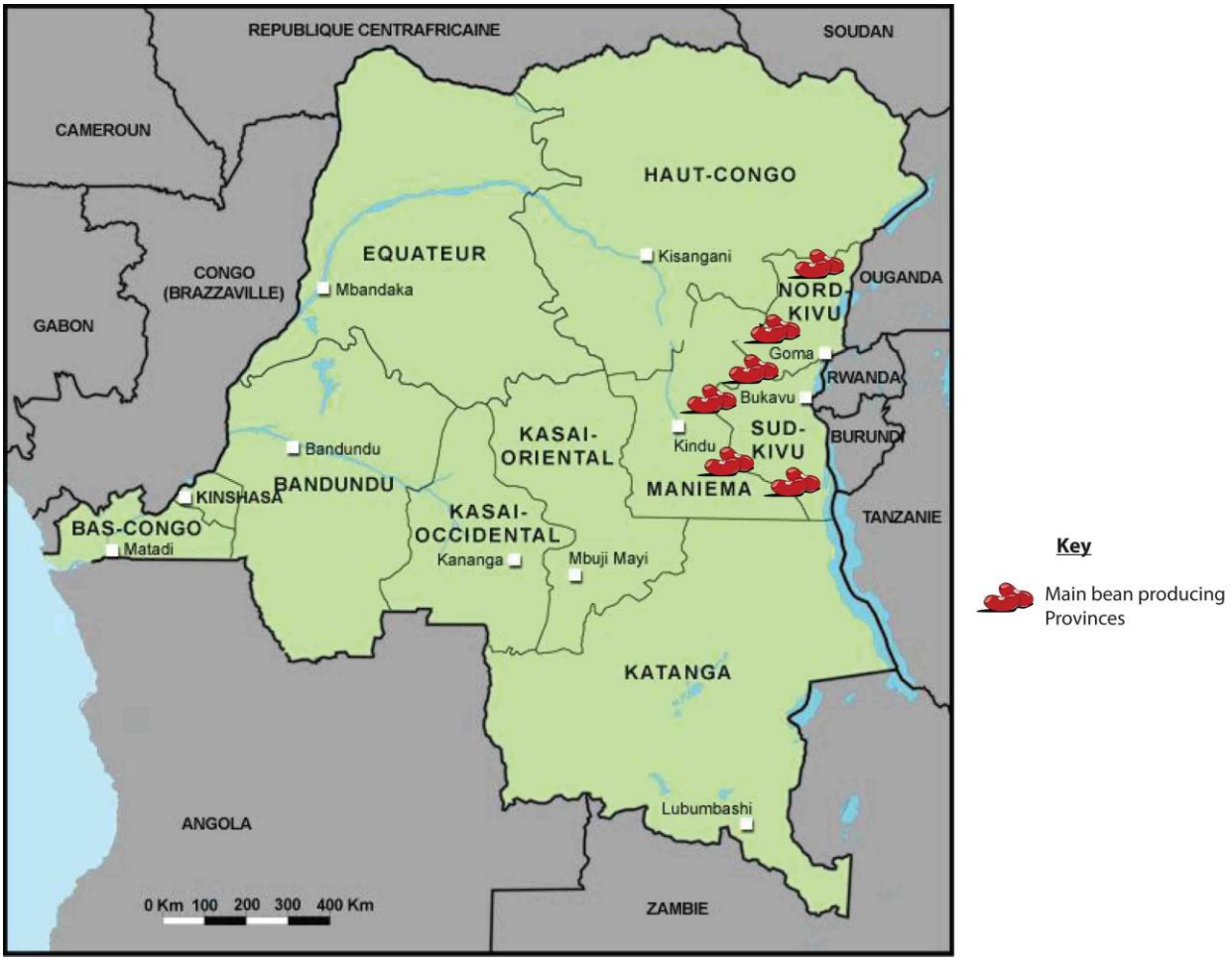


Figure 1. Map of the DRC showing the main bean producing provinces.

Agronomy and Production Trends

Beans are warm season crops that require full sun for good growth and yield. Although they grow in a wide variety of soils, sandy loam soil is best, with soil pH between 6.0-6.8 (Wells, 2001). With a favorable average annual rainfall of 1,550mm and temperature ranging from 2-26 degrees C, North Kivu province is important in the DRC for the production of beans. DRC is dealing with the effects of nearly two decades of conflict that contribute to sporadic violence, insecurity, displacement, and political upheaval and continue to impact local economies and livelihoods particularly in the eastern provinces (FEWS NET, 2015). Due to prolonged conflict and insecurity in the region, overall bean production in DRC dropped from its 1994 peak of 180,000 metric tons to 107,000 metric tons in 2002, and is still recovering to reach these previous levels (USAID, 2015). For about a decade, from between 2000 to 2009, North Kivu produced close to 50% of the

country's bean production. Also, from 2009 to 2014, however, bean production in the province doubled to almost constituting 89% of the country's bean production.

This plummet in production has been attributed to the influx of numerous NGOs during this period to support agricultural activities. Table 1 shows bean production (MT) in North Kivu province and the DRC from 2000-2014. A graphical representation of the table is also shown in Figure 2.

Table 1. Bean production (MT) in North Kivu Province and DRC from 2000-2014

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
DRC	122,000	114.49	107,440	108,390	109,340	110,300	111,270	112,248	113,236	114,239	115,237	116,251	125,000	130,000	130,000
North Kivu	56,468	52,986	49,723	50,163	50,603	51,047	51,493	51,943	52,397	52,855	106,397	110,216	114,415	114,822	115,230

Source: INS (2015), FAOSTAT (2016)

Dry beans are one of the staple food and income sources for the North Kivu region, and several varieties of different colors, qualities and tastes are produced. North Kivu has an active export flow to the South Kivu region, as well as to national markets (e.g., Kinshasa) and regional export destinations.

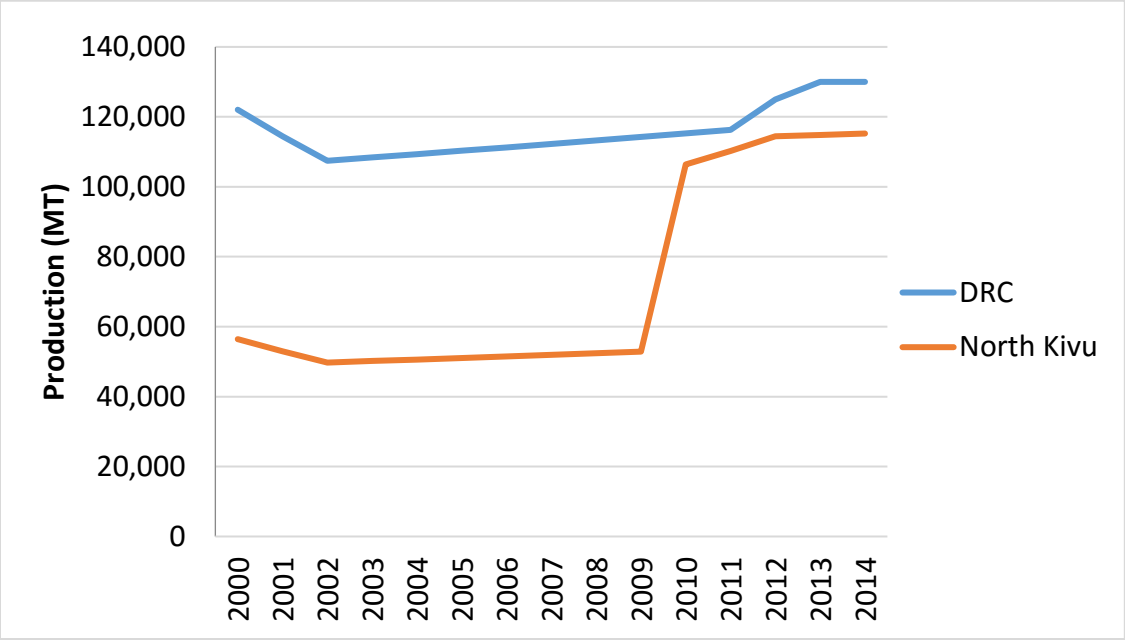
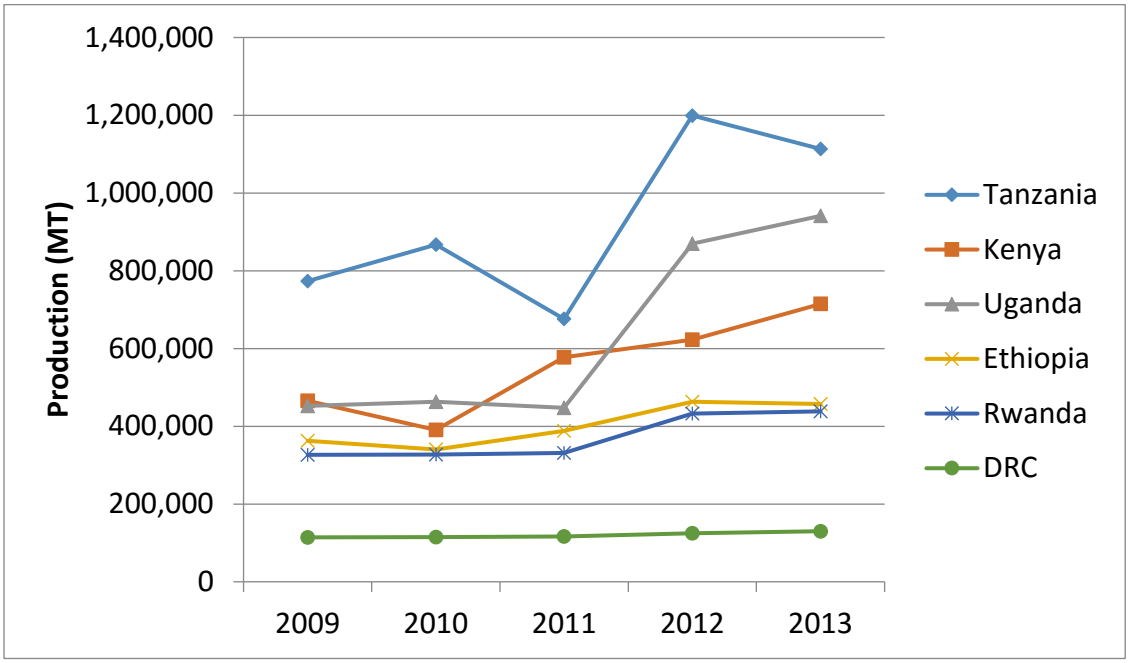


Figure 2. Bean production (MT) in North Kivu Province and the DRC, 2000-2014

Dry bean production in the DRC however has remained consistently relatively low compared with other bean producing countries in the region. The main reason for low production has been the

persistent armed conflict that the country has experienced. Figure 3 shows bean production trends (MT) of selected ECA countries from 2009 to 2013.



Source: FAOSTAT (2016)

Figure 3. Bean production (MT) in selected ECA countries from 2009-2013

Based on this trend, DRC has comparative disadvantage in the production of beans when compared with the neighboring countries. The possibility of exporting to these countries therefore remains minimal, although cross-border trade to Rwanda, Uganda and Tanzania is very common.

Role of Beans in the Food Chain

The common bean, *Phaseolus vulgaris L.,* is the most important food legume for direct consumption in the world (FAO, 1999). It is produced in a range of crop systems and environments in diverse regions. In Africa, beans are grown mainly for subsistence where the Great Lakes region has the highest per capita consumption in the world.

Nutritional Value of Beans

Beans are a nearly perfect food; nutritionally rich, a good source of dietary protein, folic acid, dietary fiber and complex carbohydrates, and one of the best non-meat sources of iron. When used with maize and rice, their amino acids are complementary. Although common bean is grown for its green leaves, pods, immature and/or dry seeds, the latter are the ultimate economic part of the bean plant. Dry seeds are appreciated throughout the developing world because they have a long storage life, good nutritional properties, and can easily be stored and prepared for eating. For the poor of the world, consumption of beans is high because they are a relatively inexpensive food and therefore a means of keeping malnutrition at bay (FAO, 1999).

Production Constraints and Identified Hindrances to Productivity and Profitability

USAID (2015) reports that yield of beans in the Kivus generally is very low when compared to the global and even the sub-Saharan African average. This is mainly attributed to the use of poor seed and other inputs, land shortage, and poor handling and storage. Beans are commonly inter planted with several other crops and several varieties planted in the same plot. Improving bean production and yield will involve promoting farming practices with limited use of artificial fertilizer and animal integration. There is no bean processing in North Kivu (USAID, 2015). Although beans could be processed into flour, producers mostly sell dried beans.

Innovation Opportunities

Innovation opportunities exist especially in processing. Bean processing begins with milling the beans into flour. In Rutshuru, as elsewhere in the DRC, several mills (*moulins)* belonging to private entrepreneurs exist because the common staple food, cassava, is made into flour and consumed as cassava bread. Other crops that are currently being milled are maize and soybean. Organisations that promote food security and nutrition in Rutshuru, such as the *Programme National de prévention, de lutte et d‟assistance humanitaires aux victimes des catastrophes naturelles* (PRONAPLUCAN) also exist, and these have been responsible for promoting the use of soybean as porridge and other products. The products have been introduced to schools, health centers and for household consumption. But no effort has been made as yet to produce bean flour. Considering that mills do exist and nutrition trainers and service providers exist, the production of bean flour by households, especially the women, could be explored to enhance nutrition and women's incomes if they can sell the flour. Bean flour could be processed further into other bean-based products. In Uganda such products have been introduced to rural communities, and urban supermarkets. One such processor is Nutreal (U) Ltd under Makerere University Food incubation center, which processes composite bean flour from dried beans. Nutreal (U) Ltd works with Makerere University's Food Science and Technology and Business Incubation Centre to produce *Multi-use composite flour (*Fig.4) selling in 18 Kampala supermarkets. This is expected will be a key market for farmers' beans as production increases.

Flour use by rural populations has been demonstrated and found to be highly acceptable (e.g., porridge, sauce, soups, snacks).

Figure 4. Bean-based composite flour (Mazur, 2012)

The processor (Nutreal) procures bean grains from open markets and a few selected individual traders. Processing usually involves testing for moisture content and drying (if not well dried), sorting, washing, extrusion (soaking, malting, roasting) and milling. Final quality control checks are then done before packaging (Kilimo Trust, 2012; Mazur, 2012).

In the DRC, this innovation opportunity could be harnessed by similarly identifying a processor, in the city of Kinshasa or Goma, and linking them to the bean producing communities. Since bean flour and bean-based products are not known in the DRC, the project would have to consider sensitization and demonstration programs in the community to promote the products.

Value Chain Analysis

This analysis is based on information that was collected in a survey at the Maendeleo IP, eastern DRC, in December, 2015. The bean value chain at the Maendeleo IP begins with seed development by research institutions, mainly INERA Mulungu and partners such as CIAT. The improved seed is made available for sale through NGOs and local stockists. However, although about 29 varieties of common bean have been released in Eastern DRC, farmers still commonly plant local varieties, saved from the previous seasons. This is because they often cannot afford the improved varieties. During the period of the study, over 90% of the IP households that

planted beans used local seed that they mostly retained from the previous seasons. Rusike *et al.* (2013) also observe that sometimes farmers purchase grain from informal markets and use it as seed. There are a few village input stockists, although the use of these inputs is minimal because they are not affordable to the majority of the farmers. The sampled households were found to have used neither organic nor inorganic fertilizer in the two planting seasons.

Production is by small scale farmers. In the survey, the sampled households on average owned 0.278ha of land while the average acreage under beans was found to be 0.678ha. Farmers on average cultivate up to three parcels of land in any given season, some of which they rent to increase the total land access. Extension services are offered by local NGOs as there are no government extension workers. Although 77% of the sample reported to have had training on soil and water conservation measures, 61% reported having used mulch, 25% having used fertilizer, 30% having planted trees, and none reported having used other practices such as trenches, ridges and water harvesting, in the study period. The average bean harvest per household was found to be 231kg, with an average productivity of 1,256kg/ha. This productivity is low, as has already been observed by USAID (2015) that in the Kivu Provinces (North and South), bean yield ranges between 0.6 – 1.5tons/ha, which is comparatively lower than in the rest of the Great Lakes Region where productivity ranges between 1.5-3.5ton/ha (USAID, 2015). Household production of beans is still low, due to the minimal use of improved seed and inputs. This then ought to be the first value chain intervention point; the improvement of household bean production and yield. This will increase the quantity that can be sent to the market, to raise the income that arises from beans.

The beans are dried, sorted and packed by the farmers in their homes. They also receive extension services on the post-harvest handling to enable them to produce dried beans of good quality, clean and pest free. Some grain is kept for food, some is treated for the following season's planting, while some is taken to the market. The most common selling outlets where the farmers take the beans are the village markets; the most commonly used markets being Kalengera, Ntamugenga and Rubare. Other farmers sell their beans to traders who pick them from the houses using their bicycles. The beans sold in the village markets are either bought for home consumption, or bought by traders from Goma for further trade in Kinshasa, and even across the borders to Rwanda, Uganda and Burundi. There are some bulk buyers such as NGOs that use the beans from the village markets for relief services, and schools for their feeding programs.

There is no bean processing; neither by the IP nor in the entire North Kivu Province. This provides the second value chain intervention point. The community has several mills where they process cassava, maize and soya bean into flour. Beans can similarly be milled into flour which can be used to make a variety of products including porridge and cakes. This possibility is already being explored in Uganda (UNDP, 2012). Alternatively, a processor to work with the IP could be identified elsewhere, e.g., in Goma, and introduced to work with the IP to develop the products. The dried beans would then be transported to Goma as the third intervention point. This would

also enable a functional upgrading of the bean value chain. A map of the current actors, processes, and services of the bean value chain is shown in Figure5 below.

Processes

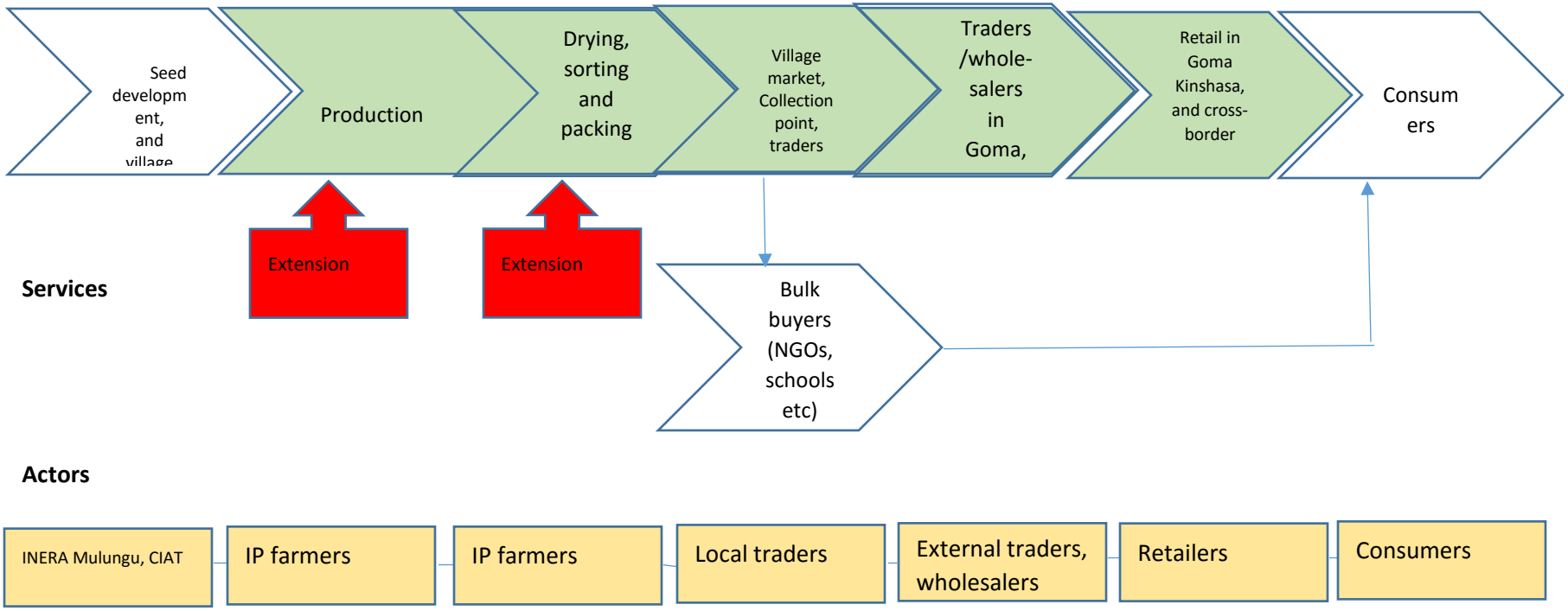


Figure 5. Mapping the actors, processes and services of the bean value chain at the Maendeleo Bean IP

Figure 6 summarizes the intervention points required in this value chain, while Table 2 is a strengths, weaknesses, opportunities and threats (SWOT) analysis of the value chain at the country level.

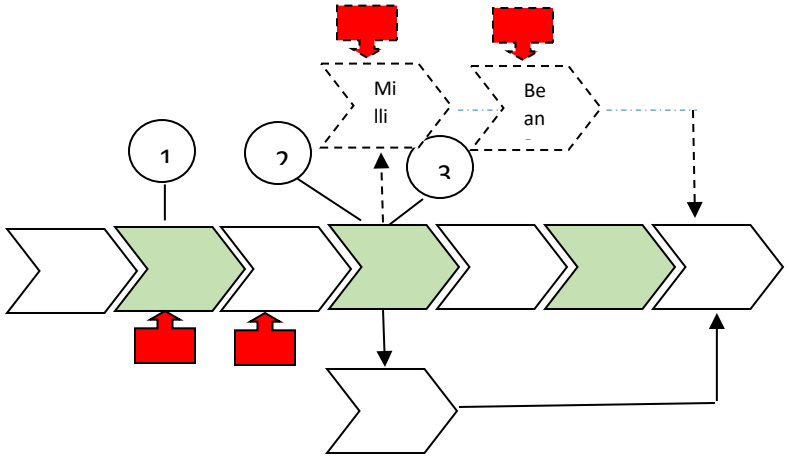


Figure 6. Value chain intervention points

Table 2. A SWOT Analysis of the bean VC

Strengths	**Opportunities**
• Beans are widely consumed in DRC, and in the region, • North Kivu produces 70% of DRC bean output, • There is a growing urban population that is demanding for quality beans for consumption, • A growing urban market that are likely to appreciate bean based products, • Beans are highly nutritious, • Already production in North Kivu is increasing,	• Good agricultural potential; good climate, soils and two seasons a year, • High demand for beans, both domestic and regional, • There are no bean processors in North Kivu, • Different varieties of beans are available, • Many organizations that can provide different services exists; extension, nutrition training, business development, credit, seed development, • There are milling machines in the community

Weaknesses	Threats
• Inadequate access to quality and affordable inputs (seed, fertilizer etc), • Inappropriate financing, • Poor farming practices, • Inadequate supply of beans to target specific markets, • Weak political environment	• A situation of sporadic armed conflict still exists, • Prevalence of pests and diseases, • Poor road infrastructure resulting in high transport costs, • Bean imports from the neighboring countries of Tanzania, Rwanda

Summary and Conclusion

Although bean production in the DRC is relatively low compared with the neighboring countries in the region, with a comparative disadvantage to participate in formal trade, innovation opportunities exist that can upgrade the value chain and enhance socio-economic benefits to the members and the entire community. Opportunity exists to improve production by working with the existing organizations for intensified provision of relevant services; extension, financial and business development. There is a possibility of introducing and promoting the milling of beans and subsequent production of bean based products together with nutrition agencies and health centers. This would however require massive sensitization campaigns for the communities to know about the new products. It would not only increase income avenues for the participating farmers especially the women but also increase the range of nutritious products available for consumption. The possibility of identifying an entrepreneur to develop and market the bean flour and bean based products will not only create an organized market that will improve prices but also create a need for increased production to meet the required quantities for supply. With the growing urban and rural populations in the country, the identified interventions would be worth exploring.

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