



FEASIBILITY STUDY FOR THE DEVELOPMENT OF PUBLIC-PRIVATE SEED DELIVERY SYSTEMS IN DR CONGO



***REPORT ON DEMOCRATIC REPUBLIC OF CONGO
SEED SYSTEMS***

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LIST OF ACRONYMS

- AGRA: Alliance for the Green Revolution in Africa
- ASS: Support Project to Seed Sector
- BAD: African Development Bank
- BUNASEM: National Bureau for Seed
- CAID: Development Indicators Analysis Cell
- CAPSA: Improved Seed Adaptation and Production Center
- CGIAR: Consultative Group on International Agricultural Research
- CIMMYT: International Maize and Wheat Improvement Center
- CREN-K: Regional Center for Nuclear Studies of Kinshasa
- CTAC: Technical Commission for Admission to the Catalog
- CTB: Belgian Technical Cooperation
- COMESA: Common Market for East and South Africa Community
- CONASEM: Seed National Council
- COPROSEM: Provincial Seed Council
- DHS: Distinction, Homogeneity, Stability
- FAO: United Nations Food and Agriculture Organization
- FIDA: International Funds for Agricultural Development
- IITA: International Institute of Tropical Agriculture
- MVAM: Analysis and cartographic System based on mobile phone
- OP: Farmer Organization
- OVS: Village Seed Organization
- PAIDECO: Support Project for Community Development Initiatives
- PAM: World Food Program
- PAPAKIN: Projet d'Appui aux Pôles d'Approvisionnement de Kinshasa en Produits Vivriers et Maraîchers
- PARRSA: Support Project for Rehabilitation and Rebuilding of Agriculture
- PARSAR: Project for Rehabilitation of Agricultural and Rural Sector
- PDDAA: Detailed Agricultural Development Program in Africa
- PDPC: Projet du Développement des Pôles de Croissance-Ouest
- PICAGL : Programme Intégré de Croissance Agricole dans le Grand Lacs
- PIRAM : Programme Intégré de Réhabilitation de l'Agriculture dans la Province du Maniema
- PMUUR: Urban and Rural Multi-sectorial Emergency Program
- PNIA: National Agricultural Investment Plan
- PRAPE: Agricultural Recovery Project in Equateur Province

PRAPO: Agricultural Recovery Project in Orientale Province

PRESAR: Agricultural and Rural Sector Recovery Project

PTF: Technical Partner and Financial

PUAA: Emergency Food Self-Sufficiency Program

SADC: Community Development of Southern African Countries

SENASEM: National Seeds Service

SNV: National Extension service

SOC: Official Control Service

STEP: Stabilisation de l'Est de la RDC pour la Paix

VAT: Agronomic and Technological Value

INTRODUCTION AND BACKGROUND

The Democratic Republic of Congo (DRC) is the second largest country in Africa with an area of 2.3 million km² (235 millions of hectares) after Algeria. Of this amount, approximately 80 million hectares or 30% of the total country landmass is suitable for farming, of which only about 10% (i.e., approximately 8 million of ha) is currently farmed (Herderschee *et al.*, 2012).

Because of its climatic diversity, its important hydrographic network, its irrigation potential estimated at 7 million hectares, its fishing potential of 707 000 tons of fish per year, its livestock potential that could support more than 40 million cattle heads, DRC is the seventh potential rich country in the world. In fact, the revenues that can be generated from its agricultural sector and all derived products can be estimated at more than 10 billion USD / year. Due to the importance of agricultural development potential and to the fact that the vast majority of its population lives in the rural areas, agriculture plays an important role in the national economy since currently 80% of the population depends on it and it contributes 45.7% to the Gross Domestic Product (GDP) (FAO et FONARED, 2018; CAID et PAM, 2018).

The DRC has a population of about 97 million people with an annual growth rate of 3.4% (BCC, 2017; Faostat, 2013), living mainly in rural areas and farming. The amount of food required to achieve the food security levels will have to increase in the same proportion as the annual growth rate mentioned above. However, in general only about 5% of this rural population depends on the formal seed sector, while the 95% still use the seeds they saved from their previous harvests. Seed is a strategic input for the development of competitive agriculture (Mabaya *et al.*, 2017).

This report is based on primary and secondary data gathered from an extensive review of literature available on the subject and group discussions with relevant government officials in Kinshasa covering the 26 provinces of the country. Interviews with key respondents and group discussions with stakeholders in Kinshasa surroundings, and Kongo Central, Kwilu, Nord Kivu, Sud Kivu and Haut Katanga provinces were carried out, using questionnaires and interactive means of communication. The report attempts to assess the public-private partnership mode of operation, focusing on major food crops notably: maize, rice; beans; groundnut, cowpeas, soybeans and cassava. These crops cover about 87% of total land area under food crops (Mabaya *et al.*, *op. cit.*, 2017).

a. Agricultural production systems

According to the different types of crops, two main production systems are currently practiced in the country:

- **Traditional agriculture**

Since the colonial era, agriculture practiced in the DRC remains primarily traditional. It is family-type and focuses on food crops, where it produces more than 80% of the country's production. It is characterized by small farm size, rudimentary equipment and a family labor. It does not use fertilizers or improved plant materials, but uses seeds and cuttings of degenerated or traditional crop varieties saved from previous harvests. The farmer devotes himself to these crops by associating several crops (cassava, maize, rice, vegetables, and fruits) in order to ensure mainly his food subsistence. He practices several crops to reduce the risk of failure. Production systems are mainly rain fed and the dominant crops are root&tuber crops, plantain, maize, rice, peanuts, beans and palm oil. Industrial crops (cotton, coffee, palm oil) can often be grown in small areas. In some provinces, particularly in the east and north-east, traditional agriculture sometimes includes livestock raising because it is the smallholder farmers who hold almost all the sheep and goats, a large proportion of pigs and poultry and produce more than 80% of the country's fish resources. These small-scale farmers are assessed nationally at about 6 million households, covering an area of 6 to 8 million hectares, or an average area per household of 1 to 1.5 ha (Plan National d'Investissement Agricole 2013-2020). The production is intended primarily for self-consumption, the surplus going to the market. The operating system is not very productive, so that the increase in production is done by increasing areas. In forest areas, this extension is at the expense of the forest. The system of slash and burn agriculture is generalized in this type of agriculture. It is therefore an extensive agriculture that consumes land and destroys forest and soil. The farmer must constantly change his land after a few years of exploitation (1-2, sometimes 3). It should also be noted that in this system, there is complete lack of innovation, funding (subsidy and credit) and lack of extension.

- **Modern or intensive agriculture**

Modern agriculture is represented by farms using a high degree of mechanization of production, particularly by the large agro-industrial companies exploiting large areas intensively, with high yields. These large plantations and / or agro-industrial units use modern production techniques with tractors for the mechanization of agricultural work, machinery and other equipment for the processing of agricultural products, high-performance agricultural inputs (chemical fertilizers, pesticides, plant material and improved animals), the use of irrigation, drainage, electrical energy and hired labor. This is the system that produces essentially the export crops (coffee, rubber, cocoa, tea, palm oil), but also maize in Haut-Katanga province and those that feed the local agro-industry (sugar cane, cotton, tobacco). It also concerns large livestock areas. Unlike the traditional system carried by family farms, large industrial farms are strongly supported by the national or international banking system.

Intensive and industrial agriculture has suffered greatly from the political upheavals that have marked the recent history of the DRC. Thus, most of the industrial exploitations that once made the country proud were abandoned because of the privatization (Zairianization) in 1973 and politico-military events in the late 1990s. This resulted in the shutdown of operations by investors (Plan National d'Investissement Agricole 2013-2020).

b. Current and recent initiatives in agricultural development

The agricultural sector has always been declared a top priority by the various authorities that have succeeded in DRC. In this regard, various development initiatives have been undertaken during the last two decades: (i) Emergency Food Self-Sufficiency Program (PUAA) 2000-2003; (ii) Triennial Support Program for Agricultural Sector Producers 2000-2003; (iii) Priority Emergency Actions (UPA) 2002-2003 (iv) Multi-sectoral Emergency Rebuilding and Rehabilitation Program (PMURR) 2000-2006; (v) The Agricultural Policy and Rural Development Note in 2009; (vi) Program of Support to the Rehabilitation of the Agricultural and Rural Sector (PARSAR); (vii) The National Agricultural Investment Plan (PNIA) in 2013; (viii) Program of agricultural seasons; (ix) Settlement Program for Agro Industrial Parks (2014); (x) Sectoral Strategy for Agriculture and Rural Development (Lebailly *et al.*, 2014).

Since March 2011, the government has adopted the Comprehensive Africa Agriculture Development Program (CAADP), which has led to the formulation of a National Agricultural Investment Plan 2013-2020 (PNIA 2013-2020) comprising seven sub-programs. All agricultural projects should be in conformity with the PNIA. None of these programs has ever been effectively implemented at all as the share of the public budget allotted to the sector has remained very low, averaging about 0.2 %, a negligible fraction of the public budget, far off 10 % recommended by AU Maputo Summit. Thus as a result, the agricultural sector has remained grossly underdeveloped, making the country to be a major food importer.

c. Scope for the development of agriculture

All of these agricultural development initiatives mentioned above did not have any significant effect because the rate of the budget allocated to agricultural development is only 0.2%, whereas the Maputo summit set an allocation of budget of 10% for each SADC member state (BCC, 2017). However, a total number of agricultural households estimated at 15,609,778 would have plante 9,367,774.9 hectares of staple food crops (cassava, maize, rice, beans, peanuts, cowpeas and soybeans) during the 2017-2018 cropping system (CAID et PAM, 2018).

I. CROP PRODUCTION SYSTEMS

In this study, eight main food crops were taken into account as major contributors to food security in the country. These are maize, rice, beans, cowpeas, groundnuts, soybeans, cassava and sweet potatoes. These crops need to be developed into full-fledged value chains to ensure that the farm sector contributes to food security, poverty reduction and overall development of the country.

1.1. Current crop production levels of major staple food crops, average crop yields, and trends, by crop

Current production data for the main staple crops can be summarized as follows (CAID et PAM, 2018):

The gross national maize production is estimated at approximately 2.4 million metric tons. It is down 29% from the 2016/2017 production. Compared with the 2013-2016 average, maize production went from 2.8 million tons to 2.4 million tons, a decrease of about 15%. The main maize production basins are the provinces of Maï-Ndombe, Kwilu, and South Kivu. These three provinces accounted for 25% of the national maize production in 2018. Besides the provinces of Kasai (94%) and Kasai Central (71%), all the other provinces recorded a fall in production compared to the previous campaign (2016/2017). The largest declines in gross production were recorded in the provinces of North and South Ubangi, respectively 69% and 62%.

The gross national production of rice is estimated at about 0.64 million tons, it went from 1.8 million tons to 0.6 million tons, a decrease of production of 37% compared to the agricultural campaign 2016 / 2017, and 64% compared to the average of the last 3 years. The main rice producing areas are the Sankuru, Maniema, Lomami, Tshopo and South Kivu provinces. These five provinces account for 49% of national rice production. The provinces of Sankuru and Maniema produced respectively 13% and 11% of the national rice production.

The cassava crop is well distributed across all provinces of the country. Gross national cassava production is estimated at 45 million tons. It is down 37% and 49% compared to the cropping season 2016/2017 and the average of the last three years, respectively. The provinces of Kwango, Tshopo and Kongo Central are the main production areas for cassava. These three provinces produce 51% of the national cassava production.

The gross production of sweet potato is estimated at about 1.5 million tons. The provinces of Lomami, Haut-Uélé, Kwilu and South Kivu are the main production areas for sweet potatoes.

Bean production is estimated at 0.53 million tons during the growing season 2017/2018. It is down 54% and 59% compared with the average of the last 3 years and 2017, respectively. The main production areas for beans are the provinces of North Kivu, South Kivu and Tanganyika. These three provinces produce 28% of the national bean production. The cultivation of beans is poorly practiced in the provinces of Tshuapa and Bas-Uélé.

Groundnut production is estimated at 1.1 million tons. The provinces with similar production include Kongo Central and Kwilu. It should be noted that groundnut cultivation is poorly practiced in the provinces of Tshopo, Tshuapa, Haut Katanga and Tanganyika. The production of groundnut is down compared to the 2017 cropping season and compared to the average of the last three years.

The decline in food production in the country can be ascribed to several negative factors notably the climatic change that has resulted in change in rainfall patterns, up-surge of pests and plant diseases, low soil fertility, low quality seeds and poor agricultural practices, without underestimating the negative impact of social and political strife that has characterized the country during the recent decades.

The data in relation to the average yields of the different basic food crops are given below:

The national average yield of maize is 0.8tons / ha. The national average yield shows a downward trend. Compared with 2017, yields fell in the vast majority of provinces except Bas-Uélé, Haut-Katanga, Kasai, Maniema, Sud-Ubangi and Lomami. In Kwilu, maize yield exhibits with an upward trend.

National average yields of rice are 0.8tons / ha, the provinces of Maniema and Haut-Uélé have the highest national average yields of rice. The lowest national average yields of rice are recorded in the provinces of Kwango and Haut-Lomami. The national average yield of cassava is estimated at 10.9t / ha. The highest average cassava yield is observed in the province of Mai-Ndombe (21.6tons / ha).

The national average yield of sweet potato is 2.2tons / ha with the highest average yield in Ituri province. Legume yields are generally very low. The average yield of beans is 0.5tons / ha against 0.7tons / ha for groundnuts. On average, farmers harvest 0.4 tons of soybeans per hectare. It should be noted that food legumes have the capacity to preserve phytovirus in their germ that can degrade the quality of the seed, and whose expression on the field leads to a drop in yield. The decline in yield observed here could also be partly explained by the (sanitary) quality of seeds used by farmers.

Table 1: Trend in production of five major staple crops (in metric tons) in the last five years

Crop	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	Average difference 2013-2016	Difference 2017/2018
Maize	1 963443	2121601	4390419	3373058	2407538	-15%	-29%
Rice	3 581542	848465	943319	1024126	642032	-64%	-37%
Groundnut	4 899991	5733714	10079527	2338231	107931	-85%	-54%
Beans	841940	675668	1536317	1292832	525726	-54%	-59%
Cassava	33 918 252	34 867 925	41 934 783	29766124	18505749	-49%	-37%
Cowpea	68094	70042	-	-	552541	-	-
Soybean	20434	20943	-	-	115802	-	-
Sweet potato	465067	477804	-	-	1446942	-	-

Source 1: CAID et PAM, 2018. Sécurité alimentaire, niveau de production agricole et animale, évaluation de la Campagne Agricole 2017- 2018 et Bilan Alimentaire du Pays, Rapport annuel, Ministère d’Agriculture, République Démocratique du Congo. 75 pages.

Source 2: World Bank, 2015. Revue diagnostique des Dépenses Publiques de base du secteur Agricole et Rural « RDPA » (2007-2013), République Démocratique du Congo Novembre 2015. 99 Pages.

1.2. Description of the country's main agro-ecological zones and their production systems

DRC has six agro-ecological zones. Their distributions and their production systems are recorded in the following Table:

Table 2: Description of the country's main agro-ecological zones and their farming systems

Agro-ecological zones	Provinces	Geographic Description	Main Agricultural Practices
South-West region	Kongo Central and Kinshasa	<p>Kinshasa - Relief: Mountains, valleys, plateaus.</p> <p>- Altitude (0 - 800 m.)</p> <p>- Climate: two climatic zones, Equatorial and Tropical.</p> <p>Rainfall (1.200 - 2.000 mm / year)</p> <p>Average temperature of 14 ° C (Kongo Central) and of 25 ° C (Kinshasa);</p> <p>- Soils: sandy, sandy-clay and limo-sandy types;</p> <p>- Vegetation: evolves from mangroves (coastline) and</p>	<p>-Mechanization of farming operations for large farms (cassava and maize)</p> <p>- Use of chemical and organic fertilizers, pesticides and improved seeds (Kinshasa, Kongo Central)</p> <p>- Irrigation (rice)</p> <p>- Practice of fallow in some areas; crop rotation and crop successions in space, slash and burn agriculture and liming.</p>

		passes through forests, savannah and Steppes	
Middle altitude zone (Middle-south)	Kwilu, Kwango, Kasai Central, Kasai, Kasai Oriental, Lomami, Sankuru (South), Maniema (Kasongo), Tanganyika, Haut-Lomami (North)	<ul style="list-style-type: none"> - Relief: Hills, plateaus -Altitude (500-1,000 m.) - Climate: Equatorial (Af and Am) in the North and Sudanese (Aw) type in the south. - Rainfall (1,500 - 2,000 mm / year) Temperatures between 10 and 30° C. - Soils: In general, kaolisols. - Vegetation: humid dense forest evergreen, dense semi-deciduous forest and savannah 	<ul style="list-style-type: none"> - Use of mineral and organic fertilizers and pesticides and improved seeds - Practice of fallow in some places; Crop succession and rotation - Relief: Hills, plateaus, slash and burn agriculture
Easter Highlands	North Kivu, South Kivu and Ituri	<ul style="list-style-type: none"> - Relief: Mountain ranges, valleys (700 - 3,000 m) with peaks reaching 5,000 m) - Climate: heterogeneous. Types Af, As, Aw, Cf. - Rainfall (800 - 2,000 mm / year) - average temperature between 15 and 23 ° C; - Soils: Volcanic type, alluvial plains, derived from ancient rocks; - Vegetation: savannahs, steppes, lowland equatorial forests and mountains, bamboo forests in high altitude 	<ul style="list-style-type: none"> - Generalization of seed use, chemical and organic fertilizers and pesticides; - Practice of crop succession and rotation and slash and burn agriculture. -Animal traction
"Dense forest zone (Cuvette centrae)"	Maïndombe, Plateau Bateke, Tshuapa, Equateur and Mongala	<ul style="list-style-type: none"> - Relief: Plains with -Altitude (320 -600 m) - Climate: Three types of climate: Af (southern part); Am (north of the Congo River) and Aw (transition zone); - Soils: limo-clay, sandy, sandy-clay and sandy-clay. - Vegetation: rainforests 	<ul style="list-style-type: none"> - Use of chemical and organic fertilizers and improved seeds - Practice of fallow in some places; of crop succession and rotation and slash and burn agriculture

		evergreen.	
North Plateau region	North-Ubangi, South Ubangi, Haut-Uele, Bas-Uele and Tshopo	<ul style="list-style-type: none"> - Relief: Plains (300 - 500 m) - Climate: Aw3 - Soils: clay and lateritic. - Vegetation: Forest galleries, woody savannah 	<ul style="list-style-type: none"> -Improved seeds, organic and chemical fertilizers; - Practice of fallow in some places, crop succession and rotation and slash and burn agriculture
Highlands of Katanga (South-East region)	Upper Katanga; Lualaba, Haut-Lomami (South)	<ul style="list-style-type: none"> - Relief: Mountains, plateaus and hills. (1.100 - 2.000 m) - Climate: Tropical humid (Aw) and warm temperate (Cw). - Rainfall (145 - 1.546 mm / year) - Soil: Red and ocher latosol type; - Vegetation: Guinean zone (dense forests in valleys and savannah) and Sudano-Zambezian zone (forests and grassy formations) 	<ul style="list-style-type: none"> -Mechanization of farming operations and use of animal traction; - Irrigation (Rice, ...); - Use of chemical and organic fertilizers, pesticides and improved seeds - Practice of fallow in some places; crop succession and rotation and slash and burn agriculture

Source 1: FAO, 2009. Second National Report on the State of Plant Genetic Resources for Food and Agriculture, June 2009

Source 2: FAO, 2012. Bulletin mensuel de suivi des prix des produits alimentaires en RDC-Décembre 2012

1.3. Current status of agricultural extension activities

In 2016, there was a total number of 1,198 agricultural extension agents in the four regions surveyed by TASA: 994 (83%) of these agents work for the Government-run National Extension Service (SNV). While the others 204 (17%) are employed by the private sector, seed producers as well as NGOs and private agribusinesses (Mugoya *et al.*, 2017).

The total number of extension workers in the DRC's four regions translates into an extension agent for 5,898 agricultural households. This rate is very low compared to other African countries. In addition, most extension workers lack funds and other resources such as vehicles to reach the remote areas of the country. This lack of means has resulted in the coordination problem of extension activities. In addition, partly because of poor infrastructure, the distribution of extension agents across the country is uneven. Ninety-two percent (1,099 out of 1,198) are based in the east, while only 7% are in the west and less than 1% in

the south. Currently, the north does not have any extension agents. Where they are present, SNV works mainly on a limited range of topics. They mainly use participatory approaches including farmer field's school. In some cases, awareness and animation are used to pass messages to farmers. The use of the media is not a common practice in assisting farmers. In addition, demonstration plots are used as a method of learning and the way to transfer technology in 43% of the cases throughout the national territory.

Agronomic research, an important link in support-counseling and technological innovation is in great difficulty. There is a gap between research and farmers. As a result, farmers find it difficult to adopt the results of agronomic research and the different themes of extension. The study thus highlighted a weak connection between National Extension Service (SNV), producers and agronomic research.

More than 8,000 producer organizations (POs) have been identified in the country. These POs are structured in union (1,171) and federation (37). On average, women make up 49% of PO members. Significant regional disparities in women's involvement in POs are observed. For example, only 6% of women are involved in POs in Equateur province compared to 72% in Kwango province. Women are more present in agricultural production POs, which is nearly 48%. On the other hand, they are underrepresented in the POs of animal production. In view of the above, the involvement of women in agricultural production remains important and should be encouraged (CAID et PAM, 2018).

It should be noted that some large agricultural projects use their own extension structures or use a foreign structure such as SNV Holland which works with the Growth Pole Development Project (PDPC) in Kongo Central. The service also is supported by two partners: the World Bank under the agricultural rehabilitation project (PARRSA) in Mongala Province, North-Ubangi and South-Ubangi and the KOICA of the Republic of Korea that has established a national extension center in Ndjili, Kinshasa Province.

This center has trained 60 extension trainers who will train others extension agents. There are also a number of NGOs providing extension support. They include among others: Caritas –Development, CDI Bwamanda, Human People-to-People (HPP), ISCO, World Vision and SNV-Netherlands with digital action plan initiated by the government, efforts will be directed to digitalize the extension activities with the support of World Bank and mobile phone companies.

1.4. Level of adoption of improved varieties

Regarding the use of improved varieties, among smallholder farmers, there is currently a very high demand for improved seeds and seedlings, which is only marginally met. In general, Congolese population is not fully aware of the importance and advantage of improved seeds. This is because of

the low diffusion of the innovations. However, approximately 5% of small-scale farmers know about the importance and advantage of improved seeds and seek for them. The seed market is not formally well structured. It remains largely informal and because of its lack of transparency, it is difficult to assess its dimensions. Small producers do not very often have access to good quality seed at affordable prices and use improved seeds only in specific cases, especially those assisted by humanitarian organizations (NGOs, FAO, etc.). For most seed operators that are still able to produce a certain amount of good quality seed, marketing is a bottleneck. Thus the seeds produced are sometimes sold as food at ridiculously low prices. This is due to the underdevelopment of the seed value chain.

1.5. Level of fertilizer use

With regard to the use of mineral fertilizers and manures, we noted a very low utilization of this input by smallholder farmers and even by the seed producers for number of reasons: (i) low purchasing power of agricultural householders, (ii) low level of extension services, (iii) high price of fertilizers per bag of 50kg, (iv) lack of skilled entrepreneurs dealing with fertilizers, who can import a huge quantity of this input (economy of scale) to lower the price, (v) limited bank schemes to access credit at low rate and (vi) lack of appropriate government policies stimulating the agricultural sector and the seed sub-sector. In fact, DRC has a deposit of potassium and phosphate rocks and needs only investors to explore these opportunities and set up plants to make fertilizers.

1.6. General description of the current marketing system of food products

The marketing system faces many difficulties related to the poor condition of rural roads (70%), to insecurity (9%), to administrative bottlenecks (8%), to storage issues (8%) and lack of supervision (5%). Every week, local people and those from neighboring villages go at least to one of the rural market to sell and / or buy agricultural products to meet their basic needs (CAID et PAM, 2018).

In fact, a price monitoring system for basic foodstuffs has been developed by the Government of the DRC to evaluate the prices of these items on the markets. It tracks an average of 350 markets per month, which are disseminated in 145 territories in the country. In each of these markets, at least three traders are contacted by telephone to provide the prices of major foodstuffs. This system, adapted from the mVAM (WFP), called "mKengela" has been managed by the Development Indicators Analysis Unit (CAID) since May 2016, with the technical support from World Food Program (WFP).

Producers are selling in order of importance: groundnuts (47%), maize (44%), rice (36%), cassava (34%) and beans (26%). These results confirm the role of cassava as foodstuff, which plays an important role in farm household food consumption. At the provincial level, Mai-Ndombe, Tshopo,

Tshuapa and Equateur market about two-thirds of maize production, about 69%, 63%, 62% and 60%, respectively. With regard to cassava production, Kwango, which is the main producing province, markets only 10% of its production, while the rest is destined for farm household food consumption. Groundnut farming plays an important role in the household economy, mainly in the provinces of Haut-Katanga and Kasai Central, where 72% and 60% of production is marketed, respectively (CAID et PAM, 2018).

1.7. Evolution of market development for food products

Global demand for cereals is estimated at around 18.7 million tons, compared with 12.6 million tons for cassava. The global demand for beans is estimated at 2.7 million tons, while the demand for groundnuts is around 2.4 million tons. This demand includes both rural and urban areas. Rural households' demand for cereals is estimated at about 12.5 million tons compared to 6.2 million tons for urban areas. On the other hand, the main demand for cassava is expressed by urban households, which need 9.8 million tons compared with 2.8 million tons for rural households.

Demand for beans for rural populations is estimated at 1.8 million tons compared to 0.9 million tons for urban households. Their demand for groundnuts is estimated at 0.9 million tons compared to 1.5 million tons for rural households. Finally, demand for potatoes is estimated at 0.2 million tons for both rural and urban households. Regarding food production, it amounts for maize, rice, cassava, beans, groundnut and potatoes to 2.4 million tons, 0.64 million tons, 45 million tons, 0.5 million tons, 1.1 million tons and 0.5 million tons, respectively. Except cassava and potatoes, the production of cereals and pulses is lower than the required amount to meet the national demand of these food products. These deficits are obviously supplemented by imports. The analysis of exchanges highlights three types of flows: internal, incoming and outgoing (CAID et PAM, 2018).

- Internal flows:

Internal flows generally occur between territories of the same province or between provinces. These flows are generally referred to as transfers from production areas to collection and / or consumption markets. These are usually short flows due to the poor condition of rural roads. In addition, because of the low storage capacity in rural markets, supply is tight; no new supply is envisaged until all the stock is nearly exhausted. This strategy has a high impact on price fluctuations. It reinforces speculation and sometimes unjustified increase in prices of staple foods on the markets. In addition, exit restrictions for food products are sometimes decided by local authorities, including territorial administrators and governors.

- Incoming flows:

Data obtained from OFIDA, 2015, indicate that inflows into the DRC are imports from neighboring countries. The DRC mainly imports cereals (maize flour and rice). Zambia's imports mainly feed food markets into the Southern region of DRC, including the province of Haut-Katanga. In addition to Zambia, maize flour is imported from Tanzania and Rwanda. The latter imports mainly feed the East region: Tanzania to Tanganyika and Rwanda to North and South Kivu. These inflows are mainly informal and do not allow any accurate estimation of their volume. In addition to traders, humanitarian actors also import cereals (maize and rice).

According to various sources, the country imports 100 to 200 thousand tons of cereals a year. As an indication, according to OFIDA, the country imported 240 000 tons of cereals in 2015. The country also imported 2,263 tons of legumes and 9,997 tons of potatoes (OFIDA, 2015). This volume of imports was used to estimate cereal and food balance sheets. In addition, humanitarian actors imported approximately 50 000 tons of cereals in December 2018. In addition to cereals, the country also imports pulses and tubers (mainly potatoes).

- Outgoing flows:

The analysis of the coverage rate and the autonomy of need coverage confirm the export trend of cassava. The country supplies neighboring countries, including Angola, South Sudan, Central Africa and Congo Brazzaville.

These flows are difficult to quantify because of the weakness of border control services and the informal nature of regional trade. People living on both sides of the border share a common cultural background that favors cross-border trade.

In addition to cassava, the DRC exports cereals, including sorghum. In 2015, the country exported 250 tons of cereals, mainly to Uganda (CAID et PAM, 2018).

II. NATIONAL AGRICULTURAL RESEARCH SYSTEM

Research plays an important role upstream of the seed sector by developing successful varieties and maintaining their identity. In general, its role extends in the multiplication of G0 to G3 or G4. Once the research develops a new variety, the seed of this new variety constitutes the breeder seed or "starting material". The variety is therefore registered in the national varietal catalog, according to a well-defined process, and it is up to the breeder to take care of its maintenance. Hence, it is important to note that varietal purity is based on distinctive criteria that determine the identity of new plant breed, thus it enriches agronomic research. The improved variety that interests us here is therefore a very exciting research product, because the emission of new plant material that is more adapted and more efficient requires time, energy and significant financial resources.

2.1. Description of the public institutes and universities actively engaged in crop breeding

The national agricultural research system in the DRC is composed of the National Institute for Studies and Agricultural Research, the Faculties of Agronomic Sciences of Universities, as well as some research centers.

a. National Institute for Studies and Agricultural Research (INERA)

INERA is under the Ministry of Scientific Research. It is a public institution that has the mandate to conduct agricultural research in DRC. It has the status of Public Establishment of scientific and technological nature, governed by the law N ° 08/009 of July 07, 2008 laying down general provisions applicable to Public Establishments and attached to the Ministry of Scientific Research and Technology. Its main tasks are agronomic research, coordination and monitoring of all agricultural research activities in the country, training of researchers and representation of the DRC in international research organizations.

Because of insufficient budget allocations, lack of equipment and infrastructure, unmotivated staff, among other deficiencies, INERA has limited its work on a few varietal selection projects of cultivars and in the maintenance of live collections. Its projects are generally funded through multilateral cooperation by International Research Organizations. Unfortunately, when these projects come to an end, the activities are usually abandoned.

INERA comprises 5 research centers, each located in a particular agro-ecological zone of the country: - M'vuazi in Kongo Central Province; Gandajika in Lomami Province; Yangambi in Tshopo; Nioka in Ituri and Mulungu in South Kivu. Apart from these centers, INERA has a network of 19 experimental stations distributed throughout the country for the adaptation of research results and the production of plant, animal and fish material. It has sixteen research programs, five of which are devoted to food crops.

- b. Regional Center for Nuclear Studies in Kinshasa (CREN-K):** established in 1959, CREN-K is a research institution that performs genetic manipulations, which effectively contribute to improving the genetic qualities of food crop seeds (FAO, 2009).
- c. The Maize Research Center (CRM):** is based in Katanga and has a partnership with CIMMYT, which made available inbred lines, allowing them to develop some varieties, including CIMA, which is diffused and sold in Katanga region.

- d. **Faculty of Agronomic Sciences of the University of Lubumbashi (UNILU):** is based in Haut-Katanga province, and has developed 5 maize varieties that are being disseminated in this region. These varieties are as follows: UNILU, KATANGA, BUKIDI-BUKIDI, APSKA and NSIMA (Rapport du Plan National Semencier, 2014).
- e. **The Faculty of Agronomic Sciences of the Université Pédagogique Nationale (UPN):** is located in Kinshasa capital, and has undertaken research aimed at the creation of improved varieties of maize, one of which has been registered in the 2019 national varietal catalog (UPN1, a varietal hybrid). Further research is underway, aimed at the creation of three-way hybrids from crosses between simple hybrids and pure lines from CIMMYT (Harare) and KALRO (Kenya). Approximately five three-way hybrids were created during the 2018-2019 crop year and are scheduled for evaluation during the next season to begin SENASEM certification and release.
- f. **ACDI, NGO located at Lusekele in Kwilu Province:** conducts research in plant breeding focusing on legumes. It has succeeded to develop three improved varieties of groundnut, known Lusekele1, Lusekele2 and Lunungu and two varieties of cowpeas. This NGO works closely with INERA and IITA in maintaining varietal purity for foundation seed and pre-basic seed. Currently, this organization is building a laboratory for seed quality control.

2.2. Nature of recent and ongoing improvement activities by crop

Research in plant breeding is currently geared to a set of objectives including among others: plant resilience against climatic change and the fight against malnutrition. Plant breeders focus on creating new plant varieties that are resilient to change in climatic conditions (drought, pest, diseases, etc.), bio-fortified (with micronutrients such as zinc, iron, etc.) and enriched with quality proteins (for example the case of quality protein maize).

INERA and the two universities (UPN and UNLU) mainly concentrate their work on collection, maintenance, adaptation trials and multi-local evaluations of different crop varieties. Research is also underway at UPN's Faculty of Agronomic Sciences, aiming at the creation of three-way hybrids, as the result of crosses between simple hybrids and maize inbred lines from CIMMYT (Harare) and KALRO (Kenya).

Approximately five three-way hybrids were created during the 2018-2019 growing season and are scheduled for evaluation during the next season before starting the registration and release process. UNILU and INERA also have the same vision to develop hybrid varieties of maize. They work in collaboration with CIMMYT, which has already granted them the licenses to produce maize hybrid varieties. In addition, INERA in collaboration with HarvestPlus is conducting trials on new and hybrid varieties rich in pro-vitamin A. INERA's research activities on rice are currently focused on the

collection and conservation of rain fed and lowland varieties, varietal maintenance as well as pre-basic and basic seeds multiplication. The lowland collection was enriched with 26 new accessions from Africa Rice. While that of the rain fed collection includes altogether more than 330 varieties/accessions.

INERA M'vuazi is working on the following soybean varieties for their registration and release: Buadi, Ntela and Davi's. There was no any new variety of Groundnuts that was added in this new edition. In addition, INERA is currently working on seven cassava varieties for their registration and release: VUVU, ILONA, KANSAKAKO, MUGOHI, LITTOY, NABANA and SAWASAWA. A project targeting the selection of beta-carotene-rich, disease-resistant and high-yielding varieties of cassava, is underway at INERA.

2.3. Level of capacity of public institutions for plant improvement

2.3.1. INERA

Currently, INERA has 19 active plant breeders for the staple food crops (i.e., cereals, legumes and root & tuber crops). The number of breeders for each sector is as follows: 4 for maize, 3 for rice, 4 for legumes, 7 for cassava and 1 for tubers. Despite this number which seems not to be too low, some of these plant breeders are not more effective due to lack of adequate infrastructure and shortage of financial resources.

INERA's operational capacity is still very weak and obsolete; the institute does not have an infrastructure capable of conducting quality seed technology operations. INERA does not have any seed technology equipment (multi-purpose modular tarar, densimetric separation screen, etc.) to produce quality seed lots. Available packaging units have been delivered as part of the VPA project and are not yet operational. In addition, the institute does not have an internal production control laboratory; this self-control would have made it possible to better appreciate the quality of the elite seeds that will be delivered to the development structures.

2.3.2. UNILU

UNILU has four plant breeders working in maize improvement. They also have expertise in agronomy, entomology and plant pathology that contribute in maize variety selection and development. They have some laboratories, including a small tissue culture laboratory and own sufficient land for field testing.

2.3.3. UPN

UPN has 4 plant breeders, three of which work in maize improvement; while one is working in soybean improvement. The lack of infrastructure is a challenge for varietal maintenance for this institution. Recently, they have negotiated with the Seed Production Center (CEPROSEM) to obtain some arable land for the multiplication of basic seed of UPN1 variety, and to have access to their cold room in order to keep breeder seed.

2.4. Recent and ongoing partnership with public institutions, farmers' organizations and private sector to provide seeds

INERA has developed an important partnership with the International Agricultural Research Centers to acquire a large number of varieties of cereals and legumes. Agricultural research is carried out in close collaboration with International Research Centers, including IITA, CIAT, Biodiversity International, CIMMYT, IRRI, ICRAF, AFRICA RICE and CIP. INERA is also actively involved in research networks organized within sub-regional and regional framework (ASARECA, CORAF, SACCAR, FARA, IRAZ, and CIALCA) as well as thematic initiatives such as AfNet.

At the national level, INERA is bound by specific agreements with projects such as PRESAR, PARSAR, PRAPO, PARRSA, PAPAKIN, PDPC, PANA-AFE, etc. The assistance of the various projects and programs has allowed this institution to have additional resources that have relieved it and have enabled it to temporarily cope with the financial requirements of its seed programs. The following technical and financial partners assisting the country in the seed development area are:

- (i) Belgian Technical Cooperation (CTB) has initiated three agricultural projects with a seed development component notably:
 - Support to seed sub-sector development (ASS) from July 2007 to October 2013;
 - Agricultural and feeder road development program in Kwilu and Kwango Provinces (PRODADEKK) from 2013 to 2018 ;
 - Agricultural development program in Eastern Kasai Province (PRODAKOR) de 2013 à 2018 ;
- (ii) AfDB has initiated two support projects to revive agricultural sector: PARSAR in Kwilu; Kwango, Mai-Ndombe and Kongo Central Provinces; and PRESAR in Eastern Kasai and Haut-Katanga, Lualaba, Tanganyika and Haut-Lomami Provinces from 2008 à 2011 ;
- (iii) World Bank has developed two projects :
 - Agricultural development support project (PARRSA) in Mongala, North and South Ubangi Provinces from 2010 to 2015 ;

- Agricultural Growth Area Development Project (PDPC) in Kongo Central Province from 2014 to 2023 ;

(iv) IFAD has lined several support agricultural development projects:

- Agricultural Rehabilitation Project (PRAPE) in Grand Equateur Province from 2004 to 2013 ;
- Agricultural Rehabilitation Project (PRAPO) in Grand Oriental Province from 2008 to 2014 ;
- Agricultural Rehabilitation Program (PIRAM) in Maniema from 2011 to 2020;
- Agricultural Support Project for food and vegetable crops in Kwilu and Kinshasa (PAPAKIN) from 2014 to 2023; and
- Agricultural Growth Program in the Great Lakes (PICAGL) au North-Kivu et South-Kivu Provinces

2.5. Seed production licensing agreements for third –party entities

Third-party entities do not yet obtain licenses to produce basic seed from the above-mentioned public institutions. Each of them remains the owner of its open pollinated varieties (OPV). However, INERA sometimes subcontracts some private entities to circumvent the constraints related to the cost of producing basic seed. In this case the third-party entities produce the basic seed under INERA technical supervision.

In addition, INERA and UNILU had just acquired licenses to produce maize hybrid varieties from CIMMYT.

III. STATUS OF SEED SUPPLY

The Democratic Republic of Congo still has a long way to go to achieve a situation where farmers have easy access to seeds of new crop varieties. Access by smallholder farmers to new varieties, developed by Congolese researchers, is limited because of the weakness of the improved seed value chain. In fact, the distribution and dissemination of improved seeds remain very limited because of the lack of reliable producers, inadequate control of seed quality and insignificant participation of the private sector. Seed multiplication is largely done by farmers ' associations or cooperatives with a reduced capacity to set up a real seed production and marketing system.

The total area cultivated in the country in 2017-2018 was about 3,079,621 ha for maize; 739,996 ha for rice; 1,984,622 ha for cassava; 1,217,066 ha for beans; 81,169 ha for cowpeas; 2,758,874 ha for groundnut and 13,383 ha for soybeans. Seed requirements to sow these areas amount to: 76,991

tons for maize; 29,600 tons for rice; 4,961,555 km for cassava; 48,683 tons for beans; 32,443 tons for cowpeas; 165,532 tons for groundnut and 669 tons for soybeans (CAID et PAM, 2018).

3.1. History of plant breeding and seed supply in the country

The history of plant breeding and seed supply in the country is linked to that of agronomic research. Agronomic research began with the creation of the National Institute for Agricultural Study and Research in the Belgian Congo (INEAC) in 1953. This institution succeeded the Plantation Board of the Colony created a little later in 1952, to ensure management of plantations and experimental stations in the colony.

INEAC was created to promote the scientific development of agriculture. The research carried out through its 32 stations and research centers focused on industrial crops and the improvement of food crop varieties in the southern sectors of Gandajika and Katanga. The scope of INEAC covered all the major ecological zones of the Congo.

In 1970, by law no. 70/061 of March 11, 1970, the National Institute for Studies and Agronomic Research (INERA) was created, which automatically replaced INEAC. INERA has focused on food crops to take care of widespread food insecurity prevailing in the country, which unfortunately continues unabated to date. Between the 70s and the 90s, variety improvement activities in the DRC were very remarkable. They have produced significant results with the creation and dissemination of several varieties, including: Salongo, Kasai1, Shaba1 and PNM1 for maize; IRAT2 and IRAT112 for rice; Tendesi, TUTA and PVO14 (low altitudes), Aliya, Kilense and Kirundu (high altitudes) for beans; Diamond, Muyaya, Vit-7 and Gandajika for cowpea; JL24, G17 and A65 for peanut; Bossier, Imperial, Davis, Munanga and Kitoko for soya; A56, Kinuani, F100 and Tshilobo for cassava; and Tshingovu and Kana for the sweet potato.

All these programs have generally been carried out in collaboration with the international organizations in the field of applied agronomic research such as CIMMYT, IITA, CIAT, WARDA, and so forth. Today, varietal improvement work in the DRC has virtually stopped. The discontinuation of the activities of the international agricultural co-operation agencies was the main cause of this state of affairs, since it was these institutions, which financed most of the research work in the country.

The most important INERA Research Programs such as the National Cassava Program (PRONAM), the National Maize Program (PNM) or the National Legume Program (PNL) have reduced their improvement work to the maintenance of live collections. The restart of the activities of international organizations since 1995 has contributed to the revival of varietal improvement in DRC.

As a result of technical cooperation with the International Atomic Energy Agency (IAEA), biotechnology techniques were used and 4,000 vitro plants of cassava local variety Boma were irradiated at different doses (FAO, 2009). These vitro plants were planted at CREN-K for phenotypic and molecular characterization and selection of resistant and high biochemical mutants was undertaken.

The Faculty of Agricultural Sciences of the University of Lubumbashi (DR Congo) and the Faculty of Bioengineers of the University of Ghent (Belgium), launched a seed production project to contribute to food production in Katanga (Democratic Republic of Congo). Specifically, it was to create a genetic bank to purify local varieties, to test the adaptation of varieties from major international centers. At the end of this project and in collaboration with the International Center for the Improvement of Maize and Wheat (CIMMYT) under the Nsima project, five productive varieties were developed. These varieties are Unilu, Katanga, Nsima, APSK and Bukidibukidi.

With regard to seed production, its history in the DRC dates back to the colonial era with the creation of agricultural adaptation and improved seed production centers (CAPSA). These centers received basic genetic materials from INEAC research and multiplied the certified seeds that were to be disseminated in the farmer community. Thirty of these centers scattered throughout the country coexisted with the local acceptance stations (SALs), which were used to acclimatize agricultural equipment. These two types of structures were therefore involved in the multiplication and dissemination of certified seeds to farmers and thus played a real role as public intermediaries between research and farmers. After its independence, DRC experienced socio-political conflicts that paralyzed agricultural production in general, and improved seed production in particular. This situation precipitated the disappearance of these structures, which led to a considerable drop in agricultural production. Among the causes of this decline is the degeneration and non-renewal of seeds.

Given this situation, our country had to put in place strategies and structures that would allow any agricultural producer to easily obtain, at the appropriate time and at a better price, the quality seed needed.

The creation of the National Seed Bureau (BUNASEM) in 1984, which later became the National Seed Services (SENASSEM) in 1990, allowed this institution to focus on seed production, control and certification activities. It has evolved during a time, due to the support of external partners. However, the country's socio-economic situation had plunged the agricultural production sector into chaos, and the lack of certified seeds exposed most agricultural producers to risks such as yield reduction, the proliferation of diseases, etc...

In 1992, a first program of support for the revival of the sub-sector was implemented by FAO through the project FAO ZAI / 92/002 "Assistance to Seed Production", project which allowed the recovery of the production of seed farms; the strengthening of seed control and certification; and the beginning of SENASEM's institutional deployment and its installation in some provinces. The achievements of this project was then consolidated under the PNASAR project FAO ZAI / 96/01. From 1994, DRC developed and implemented its first National Seed Plan, with the support of partners such as the World Bank, UNDP and FAO. The objective of this plan was to develop a real national seed industry that could supply the agricultural sector with seed in sufficient quantity and of quality with the prospect of exporting the surplus. During this period, seed production systems were liberalized. This first experience of privatization failed to produce tangible results.

Starting in 2002, the DRC, in collaboration with the technical and financial partners, developed several programs and projects to improve the seed subsector, including PARSAR, PRESAR, PRAPE, PRAPO, HUP and PAIDECO, financed by the ADfB and IFAD. This dynamic is maintained in the context of cooperation with FAO, the Kingdom of Belgium and the World Bank. FAO has helped to strengthen the operational capacities of SENASEM; and initiated the updating of the Varietal Catalog, the equipment of the Kinshasa laboratories, and of 2 provinces, and the drafting of the seed law (subsequently completed by ASS). BTC intervened through the projects:

- i. Improvement of Plant Production to strengthen the operational capacities of INERA stations to improve crop production in seed centers;
- ii. Support to the seed sub-sector whose actions are oriented towards the institutional structuring of the sub-sector, institutional and operational support to SENASEM, setting up of CONASEM and COPROSEM, training and supervision of producers of certified seeds, support seed promotion and establishment of a support fund.

Since 2014, a new national seed plan has been developed, which aims to support the country with: (i) Seed Sub-Sector Development Strategy, and (ii) Integrated Priority Investment Plan to strengthen the institutional and operational capacities of each segment of the national seed system.

3.2. Recent and ongoing improved crop varieties activities by crop

The last edition of the national varietal catalog dates back to 2012, due to lack of funds. It has been updated just now in 2019. This new edition has three volumes: cereals (maize and rice), legumes (beans, groundnuts, soybeans and cowpea) and root & tubers crops (cassava, sweet potato and Irish potato) as well as banana. A number of crop varieties has been eliminated from catalogs as INERA was unable to maintain their genetic purity because of lack of resources.

The cereal catalog contains 50 varieties among which twenty eight varieties (17 maize and 11 rice) are new (See Table 3).

Table 3: Catalog of Cereals, 2019

Cereals	Number of varieties in the 2012 Catalog	Number of varieties deleted from 2012 Catalog	Number of varieties added in 2019 Catalog	Number of varieties in the 2019 Catalog
Maize	13	3	17	27
		BABUNGO		
		BAMBOU		
		TAMBO		
Rice	20	8	11	23
		IAO2	BUMBANA	
		IRAT 216	YANGAMBI 1	
		IRAT 233	YANGAMBI 2	
		NERICA3	YANGAMBI 3	
		NERICA 6	YANGAMBI 4	
		PNR1	YANGAMBI 5	
			ARICA2	
		PRERP1	GIZA182	
		PRERP3	NERICA-L-14	
	IR64			
	NERICA-L-17			

Source: SENASEM, 2019a. Catalogue National Variétal des cultures vivrières (céréales : maïs et riz). Ministère de l'Agriculture, Kinshasa, RDC.

Table 3 shows that from 2012 to 2019, the number of varieties developed passed from 13 to 27 for maize, 20 to 23 for rice.

The new maize varieties added to the catalog are: AMANI, APSKA, BAZOOKA, BUKIDI-BUKIDI, INERA1, KIPOPO1, KIPOPO2, KIPOPO3, KISANGA, KITOKO, MAMBOTE, NKANDAMENA3, NKANDAMENA4, NSIMA, PVA SYN18F2, SAM4 VITA and UPN1. The following maize varieties are bio-fortified, notably PVA SYN 18F2 and SAM4 VITA, and 3 are quality protein maize including: MUDISHI 1, MUDISHI 3 and UPN 1.

The catalog of legumes includes 90 varieties with 45 new varieties (29 beans, 11 groundnuts and 5 cowpea) (See Table 4).

Table 4: Catalog of Legumes, 2019

Legumes	Number of varieties in the 2012 Catalog	Number of varieties deleted from 2012 Catalog	Number of varieties added in 2019 Catalog	Number of varieties in the 2019 Catalog
Beans	37	13		54
			CUARENTINO 0817	
			RWR 2154	
			RWR 2245	
			NAMULENGA	
Groundnuts	11	7	11	15
		A 1052	BUBANJI	
		ICGM 281	CG7	
		KIMPESE	CHALIMBANA	
		MBUAKI	JL24-2	
P43 MGV4 JL-24 G17	LUNUNGU LUSEKELE1 LUSEKELE2 KIPOPO6 MULAMI MUTEKENA SIVI			
Cowpea	11	1	5	15
		MUKUMARI	KIESE	
			NGEMBA	
			ZOLA MUBUENGA1 MUBUENGA2	
Soybean	10	4	0	6
		IMPERIAL		
		TGX 573-2095		
		TGX 1440-1D		
		TGX 1830-20		

Source: SENASEM, 2019c. Catalogue National Variétal des cultures vivrières (légumineuses : haricots, arachide, niébé et soja). Ministère de l'Agriculture, Kinshasa, RDC.

Twenty nine new varieties of beans were added to the catalog, among which four of them mentioned in the table above are bio-fortified. Two other new varieties of bean (HM21-7 and ZKA98-6M/95) are being tested and will be soon registered and released. Five varieties of cowpea were added in the new varietal catalog: KIESE, MUBUENGA 1, MUBUENGA 2, NGEMBA and ZOLA. Four

varieties of soybean were discarded from this new edition since they have not been maintained by any INERA stations.

The catalog on root & tuber crops has 74 varieties with 19 new cassava varieties, including: LUMONU, VIMPI, KINDISA and MUKOLESHI, which are bio-fortified. All these new varieties have just been released (See Table 5).

Table 5: Catalog volume of Roots & Tubers crops and Banana

Roots & Tubers crops	Number of varieties in the 2012 Catalog	Number of varieties deleted	Number of varieties added	Number of varieties in the 2019 Catalog
Cassava	24	8	19	35
		LUEKI		
		PAPAYI		
		MALYOHA		
		MAPENDO		
		PAPAYI		
		MUSIMWA		
		MVUAMA		
		SADISA		
		MWAD KASANGA		
Sweet potato	10	0	0	10
Irish potato	8	0	0	8
Banana	21	0	0	21

Source: SENASEM, 2019b. Catalogue National Variétal des cultures vivrières (racines, tubercules et bananier). Ministère de l'Agriculture, Kinshasa, RDC.

Table 5 indicates that from 2012 to 2019, number of cassava varieties passed from 24 to 35. Eight were removed from the catalog and 19 were added, notably: BOMENGO, GIMBI, KAMANA NZALA, KIZIMBANI, LITTOY, LONGO-LONGO, LUBILANJ, MUTIENE, MUZURI, NZOAZUZU, OBAMA2, ILONA, KANSAKAKO, VUVU, WINA, LUMONU, VIMPI, KINDISA and MUKOLESHI. Four of these varieties were bio-fortified and are: LUMONU, VIMPI, KINDISA and MUKOLESHI. With regard to Irish and sweet potatoes, virtually no research work was undertaken during this period.

3.3. Recent and ongoing activities aimed at increasing supply of improved seed

There are several mechanisms of seed distribution and sale that coexist in DR Congo: sale of seed on credit, village seed organizations (OVS), partial seed subsidization, and total seed subsidization.

- **Sale of Seed on Credit:** is the most common seed sale mechanism, where the projects receive the basic seed produced by INERA and/or UNILU, and redistribute them to the agri-multipliers.

The latter multiply these lots of seeds and return in kind to the projects a quantity of R1/R2 seeds, according to terms of the contract. In this seed sale mechanism, the credit conditions are variable. For example, the seed producers grouped within the Association of Seed Producers of Kasai Oriental, the rule is to exchange 2kg of product for 1kg of seed received. The seed operators involved in this sale mechanism cannot adapt to a situation created by the closure of these projects. Therefore, seed sharecropping does not help to create a stable and viable seed market; it does not lead to the monetization of the market. A private enterprise (Strategos Plantations in Kwilu) sales the seed on credit and buys back the entire production after deducting the cost of seed estimated to be the double of the amount of seed given to the producers, the rest of the output is milled and sold in the market.

- **Village seed organizations:** Interesting experiments are being conducted by village seed organizations in Kongo Central and Kwilu. They have developed the distribution strategies that allow them to occupy the market and to build relationships with many national institutions (Agricultural Campaign, Agricultural Village, etc.), international NGOs (Red Cross, Agri Sud, Caritas etc.) and projects. For example, KINZAU MVUETE's OSV GRAB has become the main supplier of basic rice seeds in Kongo Central. These structures generate significant annual turnover just for the sale of seeds. They earn revenues that reach hundreds of thousands of Congolese francs or tens of thousands of US dollars. These structures seem to be stable and economically viable (Rapport du Plan National Semencier, 2014).
- **Partial seed subsidization:** where by the producers and the financial partners contribute to the cost of seed used. A number of development projects have adopted this mode of assistance. They include among others: PARRSA in Mongala, North and South Ubangi; as well as PDPC in Kongo Central. The two projects are financed by the World Bank, using a co-financing mechanism where the producers and the bank contribute 50% respectively to the cost of the project. They have succeeded to reach 105,532 farm households and help establish after training in business and marketing, 92 shops for seeds and other farm inputs in South-Ubangi Province and 32 in Mongala Province.
- **Total seed subsidization:** is applied in zones covered by PPAKIN. This project buys basic seeds from INERA and distributes to seed producers grouped in 20 farm unions and 3 NGOs. These operators produce in turn R1 seed. The R1 output is distributed to Farm Organizations for the production of R2 that could be used for the production of the crop.

Table 6: Dissemination of quality grain seeds and cassava cuttings in Kwilu by PAPA KIN, 2018

Crops	Quantity distributed	Number of households reached	Area cropped	Production obtained	Average yield in tons per ha
Maize QPM (mudishi)	311.410 kg	38.900	19450 Ha	45860 T	1,5T to 2,5T
Cassava (zizila and nsansi)	900000 Linear meter	5000	720 ha	20500 T	25T to 30T
Groundnut JL 24	2360 KG	40	20 Ha	10000kg	300kg to 600kg
Cowpea VITA 7	1080 KG	108	54 Ha	27000kg	400kg to 600kg

Source: PAPA KIN Interim Report, June 2019; Survey carried out in 2019.

Other short-term activities planned with the assistance of technical and financial partners to increase the supply of improved seeds in different regions of the country are summarized in table 7.

Table 7: Estimated quantity of certified seeds of various crops, 2019.

N°	Partners	Province	Crop	Area (ha)	Estimated production (tons)
1.	FAO	North-Kivu	Beans	217	130
			Maize	330	495
			Soybean	77	46
		South-Kivu	Beans	61	37
			Cassava	22	440 linear meters (LM)
			Maize	72	108
			Soybean	15	9
			Groundnut	38	23
		Sankuru	Rice	25	20
			Maize	10	15
			Cowpea	11	7
Cassava	4		80 linear meters		
2.	STEP financed by the Social Found of DRC (FSRDC)	Ituri	Cassava	87	1740 LM
			Rice	8	6
			Maize	65	98
			Beans	180	108

			Groundnut	1	1
3.	PAPAKIN financed by IFAD	Kwilu	Maize	234	351
			Cassava	100	2000 LM
			Cowpea	54	32
			Groundnuts	20	12
4.	PARRSA-FA financed by World Bank	Mongala	Maize	40	60
			Rice	17	14
			Groundnuts	59	35
			Cowpea	2	1
		North-Ubangi	Maize	23	35
			Rice	9	7
			Groundnuts	32	19
			Cowpea	1	1
		South-Ubangi	Maize	43	65
			Rice	17	14
			Groundnuts	64	38
			Cowpea	2	1
5.	PDPC financed World Bank	Kongo Central (Madimba, Mbanza-Ngungu, Songololo, Boma, Lukula et Tshela)	Cassava		
			Rice	-	-
6.	PICAGL	South-Kivu	Cassava	1100	22000 LM
			Rice	448	267
		Tanganyika	Cassava	640	12800 LM
			Rice	365	292
7.	PIRAM financed by IFAD	Maniema	Maize	39	59
			Rice	36	29
			Groundnut	38	23
			Cassava	10	200 LM

Source: Interim report of SENASEM, Jun 2019; Survey carried out in 2019.

3.4. Current options for smallholders to access improved seed

Although there is a great need to improve the production of certified seeds at the national level for maize (76,991 tons), rice (29,600 tons), groundnuts (165,532 tons), beans (48,683 tons), cowpea (32,448 tons), soybean (669 tons) and cassava (4,981,555 linear meters), there are no clear initiatives from the government to help the seed producers to produce sufficient quality seed, and more importantly to help the smallholder farmers to easily gain access to this input at an affordable price. In fact, DRC government does not have smart seed subsidy programs to assist the small-scale farmers. There are some aid agencies, most of them are concentrated in the Eastern region, where much is needed.

They provide the smallholder farmers with low quality seeds, which they buy at the local market (about 93%). It is true that these organizations source seeds by issuing tenders to private seed suppliers in the area. However, they request a low price to buy the seed (e.g. USD 0.9/kilo of maize seed), which seed producers cannot afford. The latter do not respond to the NGOs' offers. As a result, the seed market opportunists are the ones that are selected as successful tenders, and who supply the NGOs with the so-called seeds (grains purchased on the local market).

The main seed aid agencies are UN agencies (e.g. FAO and WFP) and NGOs such as Caritas, the International Committee of the Red Cross, the Norwegian Refugee Council and World Vision International. According to the seed producers surveyed, seed sales to the emergency market in 2016 accounted for 22% of total maize sales, 40% of total rice sales, 72% of total bean sales, and 41% of total sales of soybean (Mabaya *et al.*, 2017).

3.5. Private seed companies operating in the country and their estimated annual supply

Currently, there are 12 private seed companies operating in the four regions of DRC where seed activities were significant. Seven of the 12 seed companies are locally owned and most are new, having started operation in 2016. The remaining ones are foreign (international) seed companies, most of which are based in the southern region of DRC. It should be noted that 7 seed companies are located in the East, 4 in the South and 1 in the West.

Table 8: Annual Productions of four individual seed producers in DRC (in metric tons) in 2018

Company/region	Maize	Rice	Groundnuts	Beans	Soybeans
STRATEGOS PLANTATIONS /West	4.5	-	-	-	-
MIMOSA/East	101	1	3	3	1
MAIDIVE/South	10	-	4		2
AFME/South	4.8	-	-	1.2	-
BON BERGER/South	35	-	-	4	3.2
Total	155	1	7	8	6

Source: Survey carried out in 2019

Most of the seed producers concentrated on maize crop, the leading staple food crop in the country. Their seed production is still low and not reflecting the potential demand for seed in DRC.

3.6. Other non-governmental and farmer-based organizations active in seed production and supply

Seed producers are organized into association at national and provincial levels: However these associations are not active. Currently, a total of 62 seed producers have focused on at least one of the four crops. Of these, 25 are seed associations while 37 are individual seed producers. Of the 62 seed producers, 37 are in the East, 13 in the West, 6 in the South and only 6 in the North of the country (Mabaya *et al.*, 2017).

3.7. Facilities and equipment available for seed processing and packaging in the country

SENASEM has some seed warehouses and 9 seed treatment plants, most of them are obsolete and some are not yet installed. Our field visit in several provinces showed that most seed producers (INERA, private companies, NGOs, Farmers Associations and individual farmers) have no structures, equipment and seed treatment, grading, packaging facilities. This bottleneck impacts negatively on seed quality.

3.8. Tonnages of seeds certified and marketed during the last 5 years by crop

From 2014 to 2018, 89 varieties were sold to farmers in the four regions: 41 varieties of maize, 20 varieties of rice, 16 of beans and 12 of soybean. The volume of certified seed produced and sold in DRC is much lower than in other countries. TASA report indicates that in 2016, the quantity of seeds marketed was about 1,807 tons for maize; 430 tons for rice; 331 tons for beans; 244 tons for soybeans and 1,028 linear meters for cassava. It should be noted that the volume of seeds produced and sold also varied by region. The Southern region produced and sold the most (52%), followed by the Eastern region (31%), the Western region (14%) and the Northern region (3%).

3.9. Number of agro-dealers currently in operation, by region

The agro-dealer is a relatively new concept in the DRC. The PASA project has begun to develop an agro-dealer network in the east, and at present, these agro-input merchants sell mostly vegetable seeds and fertilizer. However, most of them do not have sufficient business or marketing knowledge. A baseline survey conducted by AGMARK in 2016 (AGMARK, 2017), revealed that North and South Kivu provinces had 199 agro-dealers. Unfortunately, the survey did not cover the other regions, so data from other regions is not available at this point. These agro-dealers reached about 19,533 farmers during the peak season and 10,245 farmers during the low season. This translates to one agro-dealer serving about 150 farmers. However, the farming population in North and South Kivu is about 1.84 million farming households derived from, which implies that most of the farmers (about 90%) are not served by agro-dealers (Mabaya *et al.*, 2017).

3.10. Level of importation of certified seed from neighboring countries, by crop

Although many seed imports into DRC are not officially documented, efforts were made to get some information about formal and informal imports for some basic food crops.

Formal imports: in 2016 about 3,712 tons of seeds were formally imported into DRC. The total volume of imports exceeds the production by seed companies because some of the imports are by agro-dealers, government agencies and NGOs who distribute directly to farmers. By crop, the volume of imports was as follows: 2,106 tons of maize seed, 180.7 tons of rice seed, 240.5 tons of bean seed, and 1,183.9 tons of soybean seed. As these figures show, the main seed imports into DRC were maize and soybean. Importers include foreign seed companies, the national and provincial government institutions (including SQAV, DPPV and IPAPPEL) and, to a lesser extent, agro-dealers. International research institutions usually import seed in collaboration with INERA. The main border entry points for the imports were Kasumbalesa, Bunagana, Kasindi, Ruzizi, and Boma. The main country sources of imports are Kenya, Rwanda, Uganda, Tanzania, South Africa and Zambia.

Informal Imports: an estimated 150.6 metric tons of certified seed was imported informally into the DRC in 2016. Most of these informal imports were maize seed (139 tons), with very few imports for beans (11 tons) and for rice (less than one ton). However, these statistics are undoubtedly underestimated as some importers are reluctant to disclose the information.

The main sources of informal seed are Zambia (by Kasumbalesa and Sakania), Rwanda (by Bukavu and Ruzizi), and Uganda (by Mahagi, Kasindi and Kabuhanga). All informal imports were in two regions - East and South. No such imports have been reported in the western and northern regions (Mabaya *et al.*, *op. cit.*).

3.11. Summary of prospects for improving seed supply

To improve seed supply, the following actions should be initiated: (i) to develop the improved seed value chain; (ii) to increase the number of reliable seed producers (local private seed companies); (iii) to invest in seed quality control and to encourage private sector participation; (iv) to assist Farmers' associations or cooperatives to evolve towards full-fledged seed companies. This will promote seed production and marketing system; and (v) the government should protect seed producers by promulgating the seed law. In addition, a poor road network, hindering the distribution of seed in the rural areas should be rehabilitated. This situation of bad roads leads most seed producers to sell their seed as food.

IV. NATIONAL SEED POLICY FRAMEWORK

The government has developed a seed policy framework in 2006 and a ministerial decree No042/CAB/MIN AGRI/2006/02/09 was enacted. A draft of seed law which was prepared in 2007 is yet to be approved by the Parliament and later on to be promulgated in to law by the President of the Republic. Meanwhile, the Belgian Development Agency (CTB) in partnership with the Ministry of Agriculture have established seed councils at the national and provincial levels. The council is made up of all the actors involved in the seed sub-sector. They meet two to four times a year to review all the issues relating to the sub-sector as it pertain to production, certification and distribution. The country is a member of COMESA and SADC. These two sub-regional groupings have harmonize seed legislation. DRC is in the process of doing the same to conform with COMESA and SADC in relation to seed certification, inspection, diffusion and commerce.

4.1. Documents which control the production and supply of seed

To date, SENASEM has developed and implemented three volumes of administrative and technical procedures of Seed Regulations, which are in line with the COMESA Seed Regulations.

4.2. Process for the official release of improved crop varieties

From filling in the application form to the publication of the catalog containing the new variety, the following steps are to be carried out: (i) Reception and evaluation of the application made by the breeder by filling in a form (accompanied by the descriptor of the variety and the seed sample); (ii) Request for additional information, (iii) Conduct of DUS and VAT tests (respectively Distinctness, Uniformity and Stability, and Agronomic and Technological Value); (iv) Preparation and transmission of the homologation report to the Technical Admission Commission at Catalog (CTAC); (v) Distribution of Certification Report to CTAC Members and Evaluation; (vi) Invitation of CTAC members to the meeting and (vii) Registration in the Catalog. The publication of the catalog is

effective once the Minister of Agriculture has enacted a decree. The new variety will then become available to farmers without ignoring the author's rights (SENASA, 2015).

4.3. Procedure for Seed Certification

The seed certification process is carried out in three steps: preparatory, administrative and technical steps. These are:

4.3.1. Preparatory steps: acceptance of the variety, its inscription to the catalog or provisional list and the consent of the seed producer.

4.3.2. Administrative steps: include the request to be admitted for the control of the seed field 90 days before the seed is planted and the declaration of the crop to be planted 21 days before the planting or sowing of the crop.

4.3.3. Technical steps: (i) Validation of the site where the seed will be planted ; (ii) first control of seed field at the emergency; (iii) second control of field at the flowering stage; (iv) third control at harvest ; (v) seed packaging and storage; (vi) Seed sampling and laboratory analysis and (vii) labeling of seed lots. Let us note that for cuttings and seedlings, the analysis of purity, water content, and weight of 1000 seed grains, germination power and sanitary conditions is not carried out (SENASA, 2015).

4.4. Current status of the regulatory agencies in charge of seed certification

SENASA is settling progressively in the provinces, decentralizing the control and certification of seeds. Currently, the official control service (SOC) covers Kongo Central, Bandundu, Equateur, Kasai Oriental, Katanga, South Kivu and Orientale, North Kivu and Maniema provinces. In addition to provincial coordination, the service is represented at the district level including Mbanza-Ngungu and Boma in Kongo Central, Kenge, Masimanimba and Bagata in Bandundu, Kabinda and Lothio in Province Orientale.

Moreover, the laboratory park is deployed in the provincial co-ordinations, where the Official Control Service (SOC) has a reference laboratory, especially those of Kongo Central, Bandundu, Katanga, Kasai Occidental and Oriental, South Kivu and Province Orientale. District support laboratories are located in Boma (Kongo Central), Kikwit and Kenge (Bandundu), Lodja (Eastern Kasai). The laboratory park has a significant capacity; it ensures more than 50% of the demand in seed analysis (SENASA, 2019: Interim report).

SENASA coordination offices at national and provincial levels that enjoy financial support from development partners are well equipped and carried out the work efficiently. SENASEM is organized as follows: one national coordination office in Kinshasa, staffed with 29 seed inspectors and 18 laboratory technicians and 25 provincial co-ordinations of which 10 are financially supported.

These provincial coordination's have 158 seed inspectors, 72 laboratory technicians, 1149 seed producers and 100 seedling producers. The ratio is estimated at 7 seed producers for one seed inspector and 16 seed producers for 1 laboratory technician. The distribution of seed inspector and laboratory technicians shows regional disparities in favor of provinces that are financially supported by donors (SENASA, 2019: Interim report). SENASEM follows two approaches:

- Support to seed producers using their own-resources. They sell 90% of their output to government, FAO and NGOs. The rest 10 % is partly used by the seed producers and sold to other farmers;
- Support to seed producers who have signed contracts with projects/programs that are supported by technical and financial partners (PTF). SENASEM has signed several contracts with technical and financial partners. These partners provide assistance in terms of seed control, certification and development of tools for the management of seed systems (varietal catalog and technical manuals relating to seed production, control and certification, guidelines for seed inspections and analysis), and contribution to the establishment of seed provincial councils (COPROSEM).

The provincial co-ordinations identify seed producers, provide the control and certification of seed produced, conduct technical backup and organize relevant meetings.

To date, ongoing partnerships are with: FAO in North-Kivu, South-Kivu and Sankuru provinces ;Social found in Ituri, Haut-Uélé and North-Kivu ; Program (PAPAKIN) financed by IFAD in Kwilu, Kwango, Kongo Central and Kinshasa provinces ; PARRSA financed by the World Bank (WB) in Mongala, North-Ubangi and South-Ubangi provinces; PDPC » financed by the World Bank (WB) in Kongo Central province; PICAGL in South-Kivu and Tanganyika provinces and PIRAM financed by IFAD in Maniema province.

4.5. Current Status of Supply of Basic Seed

INERA and UNILU are the major sources of basic seeds in the DRC. The two institutions work in close collaboration with other agricultural institutions and projects, such as the CGIAR institutions (IITA and HarvestPlus). Twenty percent of maize producers purchase their basic seeds from agricultural research institutions in neighboring countries such as ISABU of Burundi, Kenya Agricultural Research

and Livestock Organization (KALRO), Rwanda Agricultural Council (RAB), and the National Organization for Agricultural Research (NARO) in Uganda. Several foreign companies in Uganda and Kenya also provide basic seeds.

On average, seed producers rate their satisfaction with the availability of basic seeds as good for the following crops: 65% for maize, 61% for rice; 63% for beans, and 62% for soybeans. Most local seed producers have indicated that they can easily access basic seeds from two main national sources: INERA and UNILU. However, there is considerable variation in the availability of basic seeds across regions. Producers in the West, East and South have easy access to basic seeds, while those in the North face challenges. Most seed producers (96% of soybean producers, 93% of bean producers, 86% of rice producers and 78% of maize producers) source their basic seeds at the local level.

INERA has forged special relationships with the projects and with a large number of international and national NGOs, it enjoys a virtual monopoly for the production and supply of basic seeds. Projects, international institutions such as FAO and NGOs constitute the bulk of INERA's clientele, they absorb between 90% and 95% of INERA's basic seeds. New projects have been launched recently and they have signed a partnership basic seed sale agreement with INERA. They include PAPAKIN and PDPC in the West and PARRSA in the North. Private seed producers utilize less than 5% of INERA's annual basic seed production (Mabaya *et al.*, 2017).

As long as the agreements linking INERA to its partners are in place, the institute has no difficulty in selling its seeds. It should be noted that at the closure of the conventions, the institute begins to have difficulties in selling its production. From 2009 to 2013, the sale of basic seeds fell by 50.3%, from 129 tons to 64 tons, for 2014 production fell to the point that the institute was unable to deliver more than 0.3 ton of basic seed of peanut. From the point of view of strategy, INERA has no visibility in the market; and has little knowledge on how to stimulate and expand an effective demand for basic seeds. Its marketing approach does not allow INERA to diversify its customer base. INERA seems to pay little attention to the after-project period to promote the development of stable and sustainable seed market (Rapport du Plan National Semencier, 2014).

Table 9: Basic Seed production cost and prices of selected food crops

Crops	Production cost per hectare (US \$)	Crop yield (tons/ha)	Price per kg (in US\$)
Maize	1915,0	1.5	2,5
Rice	1900,0	0.8	2,5
Groundnuts	1200,0	1	3,0
Beans	910,0	0.8	3,0
Cowpeas	1370.0	0.6	3,0
Soybeans	1370,0	0.6	3,0
Cassava	-	20000 LM	0.06 \$/LM

Sources: Rapport du plan National Semencier (2014); surveys conducted in 2019

The price of basic seeds per kilogram is not high by any standard. However, due to low purchasing power, farmers are unable to meet this price.

4.6. Procedures for production and supply of basic (foundation) seed

A number of steps has been defined for those who have elected to produce and distribute basic seeds. These steps are:

- (i) To be registered as seed producers and to acquire technical manual and crop catalog ;
- (ii) Training of seed producers by SENASEM ;
- (iii) Application to the control of the field 90 days before seed sowing or planting ;
- (iv) Seed sowing or planting;
- (v) Specification of the crop and the origin of the variety 21 days after planting
- (vi) Control by SENASEM inspectors : 3 times (at emergency, flowering and harvest) ;
- (vii) Harvest and treatment ;
- (viii) Making seed lots for analysis (genetic variety purity, water content, germination power, weight of 1000 grains and sanitary conditions of the seeds)
- (ix) Labeling and sealing of the seed lots; and
- (x) Delivery of the seed certificate or report.

a. Access of private seed companies to basic seeds

Most private seed companies acquire the basic seed supply from INERA and UNILU, the two major sources of basic seed supply in the country. These research structures work in close collaboration with other institutions and projects such as IITA, Harvest Plus and Africa Green Revolution Alliance (AGRA).

Twenty percent of maize producers buy their basic seeds from research centers from neighboring countries such as ISABU in Burundi, KALRO (Kenya Agricultural and Livestock Research Organization) in Kenya, RAB (Rwanda Agricultural Board) du Rwanda and NARO (National Agricultural Research Organization) in Uganda. And several foreign seed enterprises established in Uganda and Kenya also provide basic seeds to Congolese seed producers. The Congolese seed producers and companies find the price of basic seeds (3.00 USD per kg) sold by INERA and UNILU as high and complain of difficulties they have to sell their R1 and R2 seeds to farmers.

b. Policies for supply of basic seed by private sector

There has been a lack of coherent seed policy in the country. Private seed companies face a lot of impediments ranging from administrative and taxation frauds. They do not enjoy any tax exemptions. The new government is poised to encourage private investment in agriculture and to provide an enabling environment with a view to improving food security and reducing poverty in the rural area of the country.

SUMMARY AND CONCLUSIONS

The Democratic Republic of Congo, one of the biggest countries in Africa with 30% of the total country landmass suitable for farming, of which only about 10% is currently cultivated. Its climatic conditions are varied with a huge hydrographic regime offering the country a great irrigation potential and fishing potential. Its population is estimated at 97 million inhabitants, the majority of whom are in rural areas. Agricultural production systems include 2 systems of which traditional agriculture is dominant characterized by small areas planted, the use of rudimentary materials; therefore, production is low and mainly for self-consumption, the surplus being destined for the market. The operating system is not very productive, so that the increase in production is done by increasing areas. Otherwise, modern agriculture is represented by farms using a high degree of mechanization of production, particularly by the large agro-industrial companies exploiting large areas intensively, with high yields. This type of agriculture went bankrupt with the zairianization (privatization) on the 23/09/ 1973 and political-military events in the late 1990s. Agriculture has since been declared priority of priorities by the successive governments. Various development initiatives have been undertaken during the last two decades. These agricultural development initiatives did not have any significant effect because the share of the budget allocated to agricultural development was only about 0.2%.

Food crop production systems are organized into cereal value chains, oilseeds and legumes value chains, root & tuber crop value chains, and fruit as well as vegetable crop value chains. Eight major food crops make an important contribution to people's food security.

These are maize, rice, beans, cowpeas, peanuts, soybean, cassava and sweet potatoes. Despite their importance, their current levels of production are sharply down compared to the 2013-2016 average, the slight decrease of which is attributable to maize (15%). Several factors explain these declining secular trends in food production in the country. These include the impact of diseases and pests, climate change and the current state of agricultural extension activities (SNV) that does not allow the dissemination and adaptation of agronomic research innovations by producers, without ignoring the severe strife that has marked the recent history of the country.

Regarding the use of improved varieties, there is currently a very high demand for improved seeds and seedlings among smallholders, but it is only marginally satisfied. Currently about 5% of small farmers have access to improved seeds. The seed market is not well structured. It remains largely informal and because of its lack of transparency, it is difficult to assess its dimensions. Small producers often do not have access to good quality seeds at affordable prices and use improved seeds only in specific cases, including those assisted by humanitarian organizations (NGOs, FAO, etc.). For most seed operators who are still able to produce a certain amount of good quality seed, marketing is a bottleneck. Thus, the seeds produced are sometimes sold as food at ridiculously low prices. This is due to the dysfunction of the seed value chain, making it difficult to play the expected role. In fact, DRC seed industry, which is at an initial stage, needs a great improvement.

With regard to the use of mineral fertilizers and manures, we noted a very low utilization of this input by smallholder farmers and even by the seed producers. The marketing system faces many difficulties related to the poor condition of rural roads, insecurity, administrative hurdles, storage issues and lack of supervision. Despite these difficulties, small producers leave from one village to another to sell their products.

This analysis has involved several stakeholders engaged in seed sub-sector in DRC notably: research institutions and universities, technical and financial development partners, farmers associations, private sector, government services and policy makers, NGOs and civil society. The aim of this study was to carry out a detailed appraisal of the production and consumption of improved seeds of staple food crops, to determine the strengths and weaknesses of the seed systems with the view to make relevant recommendations to develop public-private seed systems in DR Congo.

To this end, critical review of the available literature, key respondents' interviews, focus group discussions were carried out to gather the pertinent data and information that have helped the production of this report. Regarding the strengths, the seed sub-sector has many motivated actors who only need assistance in terms of capacity building and financial support.

There are capable public institutions (parliament, presidency, government, ministry of agriculture) that could have the legal framework and regulation to secure the national seed sub-sector; a staffed national research system and a national seed service; the country has a large potential demand for improved seeds and seedlings.

Nevertheless, the seed systems show several weaknesses, including:

- Limited utilization of productive potential of crop varieties due to poor agricultural practices such as slash and burn mode of production, low utilization of fertilizer and limited control of weeds, pests and diseases;
- Hybrid system of seed producers (i.e., individual seed producers, group and associations of farmers, NGOs, and local and international private seed companies) hinders the production of quality seeds;
- Low adoption of improve varieties by farmers as result of poor extension services ;
- Inefficiency of research institutions due to lack of financial and material resources;
- Inefficiency of marketing system and volatility of prices of food products leading to low farm revenues;
- Weak organization of seed producers in many regions;
- Poor rural roads and absence of facilities for treatment, grading, packaging and storage of seeds;
- Limited public intervention in the distribution and promotion of quality seeds and seedlings ;
- Lack of seed law to harmonize the partnership between public and private sectors in seed production and distribution, among other things.

We then recommend the following:

- To promulgate the seed law, which has been prepared and harmonized with regional seed legislation of COMESA and SADC ;
- To reinforce the collaboration between INERA, Universities and seed producers;
- To strengthen the productive capacity of seed producers and to improve seed treatment and storage facilities;
- To train plant breeders in order to promote research in plant variety improvement ;
- To organize the extension system and well train and equip the technicians.
- To stimulate the diffusion of innovations at the farm level;

- To encourage seed projects that should have a national character and a similar approach as well as strengthen their coordination at the national level;
- To develop marketing systems

Finally we encourage policymakers, private sector, development agencies and other stakeholders to invest, among others, in development of the seed sub-sector with a focus on smallholders in order to boost agricultural production in the country.

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