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ECONOMIC GROWTH PROJECT

STRATEGIC OPTIONS FOR THE SEEDS VALUE CHAIN IN SENEGAL

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LIST OF ACRONYMS AND ABBREVIATIONS

AGRA	Alliance pour la Révolution Verte en Afrique (Alliance for Green Revolution in Africa)
ANCAR	Agence Nationale de Conseil Agricole et Rural (National Agency of Agricultural and Rural Counsel)
ASPRODEB	Association Sénégalaise pour la Promotion du Développement à la Base (Senegalese Association for the Promotion of the Community-based Development)
CCR	Comité de Concertation Sous-Régional (Committe of Sub Regional Dialogue)
CERAAS	Centre d'Etude Régional pour l'Amélioration de l'Adaptation à la Sécheresse (Regional Center of Studies for the Improvement and Adaptation to the Draught)
CLCOP	Cadre Local de Concertation des Organisations de Producteurs (Local Framework of Dialogue for the Producers' Organizations)
CNCAS	Caisse Nationale de Crédit Agricole du Sénégal (Senegal's National Bank of Agricultural Credit)
CNCR	Conseil National de Concertation et de Coopération des Ruraux (National Council of Rural Dialogue and Cooperation)
CSA	Commissariat à la Sécurité Alimentaire (Food Security Commission)
DPCS	Direction de Production, de Contrôle et de Certification des semences (Directorate of Seeds Production, Control and Certification)
DISEM	Division des Semences (Seeds Directorate)
DPDA	Déclaration de Politique de Développement Agricole (Policy Statement of Agricultural Development)
DRDR	Direction Régionale du Développement Rural (Regional Directorate of Rural Development)
DSRP	Document de Stratégie de Réduction de la Pauvreté (Poverty Reduction Strategy Document)
FAO	United Nations Food and Agriculture Organization
GIE	Groupement d'intérêt économique (Economic Interest Group)
IFAD	International Fund for Agricultural Development
ISTA	Association Internationale d'Essais des Semences (International Seeds Testing Association)
ISRA	Institut Sénégalais de Recherche Agronomique (Senegalese Institute for Agronomic Research)
MEF	Ministry of Economy and Finance

LOASP	Loi d'Orientation Agro-Sylvo-Pastorale (Agro- Sylvo- Pasporal Orientation Law)
LPDA	Lettre de Politique de Développement Agricole (Policy Letter of Agricultural Development)
NEPAD	Nouveau Partenariat pour l'Afrique (New Partnership for Africa Development)
NGO	Non Governmental Organization
OP	Organisation paysanne (Farmer Organization)
PDMAS	Programme de Développement des Marchés Agricoles du Sénégal (Development Program of Senegal's Agricultural Markets)
PICA	Points d'Information Commerciale Agricole (Points of Commercial and Agricultural Information)
PNASA	Programme National d'Appui à la Sécurité Alimentaire (National Program of Support to Food Security)
PNAR	Programme National d'Autosuffisance en Riz (National Program of Rice Self-sufficiency)
PNDA	Programme National de Développement Agricole (National Program of Agricultural Development)
PNDL	Programme National de Développement Local (National Program of Local Development)
POGV	Projet d'Organisation et de Gestion Villageoise (Project of Village Organization and Management)
PSAOP	Programme de Soutien aux Services Agricoles et d'Appui aux Organisations de Producteurs (Program of Support to the Agricultural Departments and to Producers' Organizations)
PSSA	Programme Spécial pour la Sécurité Alimentaire (Special Program for Food Security)
PROGES	Projet de Gestion de l'Eau dans la Zone Sud (Southern Zone Water Management Project)
REVA	Programme retour vers l'agriculture (Program for Return to Agriculture)
ROPPA`	Réseau des Organisations de Producteurs de l'Afrique de l'Ouest (Network of West Africa's Producers' Organizations)
SDDR	Service Départemental du Développement Rural (Departmental Service of Rural Development)
SDR	Société de Développement Rural (Rural Development Company)
SOC	Service Officiel de Contrôle (Official Control Department)
TVA	Taxe sur la Valeur Ajoutée (Value Added Tax)
UCAD	Université Cheikh Anta Diop
WAEMU	West African Economic and Monetary Union
WASA	West African Seeds Alliance

I. INTRODUCTION

Under the support of the Government of Senegal for the implementation of its Accelerated Growth Strategy, The United Agency for International Development (USAID) provides a regular support to the USAID Economic Growth Project (USAID/PCE), in developing and implementing policies and strategies destined to promote economic growth, and improve the enterprises competitiveness and jobs creation.

The USAID/EGP project intervenes in three major areas:

- The support to the development of enterprises likely to rapidly gain shares in domestic or foreign markets, particularly in the sub sectors of the staple products such as rice, maize, millet and sorghum, as well as livestock;
- The creation and strengthening of public-private partnership in order to promote private investments destined to ensure the provision of goods and services ;
- The support to reforms for the creation of an environment favorable to investment, growth and the agricultural sector development.

The USAID/EGP project has a Business Development Services (BDS) component which mission is the strategic development of the sub sectors of the staple products with a particular focus on the improvement of productivity and competitiveness. In this respect, the component uses the « *Value Chain* » approach which is market driven. This approach allows having a better visibility on the opportunities of the private sector intervention, and incomes generation by the different actors intervening in the agricultural sub sectors.

Thus, in-depth thoughts were given to the consumers' wishes and the products marketing conditions. These thoughts revealed several major constraints including the lack of quality which seriously compromises any strategy of the agricultural sector development. To this end, the EGP put in place a team of experts charged with analyzing in the field the real development problems of the seeds value chain, and proposing appropriate solutions. The team was composed of Gabriel Bassène and Abba Diémé (Seeds Experts) and Amadou Diouf Fall (Economist), and worked under the supervision of Dr. Amadou Moustapha Bèye (Senior Researcher of the Rice Center for Africa, former WARDA).

It should be reminded that if during the first years of independence, the seeds problem was not well perceived, it was because there existed seeds' stocks of the main cereals at the development companies level. However, these stocks disappeared throughout the years. There have been three successive departments which saw their functions changed, and the certification formerly conducted with much rigor, was reduced to a simple acknowledgment of stocks given with a few laboratory analyses. The monitoring and control activities which enabled to provide support/advisory services to the producers in the area of quality management during the entire agricultural campaign -- almost entirely disappeared.

Thus, each year, in the inception of the rainy season, the government sought in vain seeds to support the farmers. The recourse to massive imports of seeds was mostly used. But it seemed to be more profitable to the traders than to the producers who often complained about the quality of the distributed seeds.

II. CONTEXT

2.1 *Geographic, economic and social framework*

2.1.1 **Socio-economic environment of Senegal's agriculture**

Senegal is essentially an agricultural country located in an arid climatic area. The cultivable lands represent 3.8 million hectares, or about 20 % of the country's total area. They are unequally distributed in the agro-geographic zones: 57 % in the Peanut Basin, 20 % in Casamance, 10 % in Eastern Senegal, 8 % in the Senegal River Valley, 4 % in the sylvo-pastoral zone (Ferlo) and 1 % in the Niayes. The annual cultivated area is about 2.5 million hectares.

The overall percentage of the irrigated agricultural lands is lower than 4 %. This shows that the country's agricultural productions heavily depend on rainfall.

Irrigation is practiced in three zones:

- The Senegal River Valley which has a strong crop diversification including :
 - **Intensive rice cultivation with average yields of 5 - 6 Tons/ Hectare and peaks of 11 - 12 Tons/ Hectare ;**
 - **Maize cultivation with yields varying from 2.5 to 6 Tons/Hectare ;**
 - **Industrial tomatoes with peaks of 60 Tons/Hectare ;**
 - **Onion, sweet potato and various vegetables of local consumption or destined to export (green bean...)**
- The Anambé Basin in Upper Casamance with rice as the main crop ;
- The Niayes area which spreads over from Saint-Louis to Dakar over a layer with a few kilometers of width. This area has a coastal climate which makes it a zone favorable to horticulture.

Outside these areas, the Senegalese producers practice diversification of rain-fed crops (peanut, millet, sorghum, cow pea, watermelon, fonio, maize, bissap, etc) distributed according to the limit precocity of the soil and climatic conditions of the areas.

In these cultivation systems, the average level of use of mineral fertilizer is lower than 40 kilograms/ hectare/ year and the soils were worn out by the peanut monoculture introduced since more than a century. The agricultural productivity is low there and the food balance is often in deficit. This situation leads the Senegalese population to import considerable food products.

According to the national statistics¹, Senegal imports on average 64% of its cereals' needs, particularly rice. During 2007 – 2008, the cereal deficit was 248 432 tons representing a decline of 9% of the rice production as well as the cereals such as millet (37%), sorghum (26%), maize (13%) and fonio (23%). The same source evokes that in the seeds area, only 15% of the areas are cultivated for quality seeds, and that this figure essentially concerns peanut. This rate would be 5% for the cereals.

The importance of the cereal deficit weakens Senegal's economy and exposes it to the changes intervening at the world level. Thus, in 2008, the price explosion in food stuff was locally felt as a surprise effect and that greatly affected the country's social stability.

¹ Ministère de l'Agriculture, *Projet de reconstitution du capital semencier du Sénégal toutes espèces*, Document de travail, 2008. (Ministry of Agriculture, *Senegal's seeds stock reconstitution, all species*, Working document, 2008.

The causes of the prices explosion are multiple but seem to be associated with a combination of circumstances marked by the: (i) the drop of the global cereals' stocks ; (ii) strong demand for various products entering in food security (iii) and the rise in oil world prices and in transportation costs.

Drop of the world stocks

The on-going drop of the rice stocks and the regular increase in the oil prices created a rise in the cereals price in the world market, particularly for rice, wheat and maize. The world stocks of many staple food products (rice, sugar, maize, cassava, oil producing plants, palm oil, etc.) were seriously tapped to the point where they reached the lowest level 25 years ago.

The situation seemed to be aggravated by the harvest losses due to climate uncertainties in big producing countries, such as Austria. This affected more the average world wheat price which increased by 122% within one year (February 2007 to February 2008).

Table 1: Evolution of prices in the world markets for some selected products (Period: February 2007 - February 2008)

	Unit	23/02/07	18/05/07	27/08/07	23/11/07	23/02/08	Evolution (%)
Rice	(\$ / t)	1 018,5	1 011.5	1 061.0	1 330.5	1 800.0	76.7
Wheat	(cents / bushel)	484.2	471.2	725.6	845,4	1 073.0	121.
Maize	(cents / bushel)	430.2	371.2	341.4	405.4	546.0	26.9
Sugar	(\$ / ton)	332.4	334.5	279.0	287.4	387.2	16.5
Palm oil	(\$ / ton)	651.5	837.0	855.0	992.0	1 372.5	110.7

Source: Marchés tropicaux, 2008

Strong demand for various products entering in food security

Among these products, a strong growth in the demand for the cereal-based bio-fuels is noted. In other respects, the world demographic growth and the strong economic growth in the developing countries did not favor the restoring of the macroeconomic imbalances.

The situation got more deteriorated with the regular drop of the dollar exchange rate and the rise in the barrel price which went within five years from 29 to 145 US dollars.

Rise in the world prices and in the transportation costs

The prices explosion was not a phenomenon limited to one single country. It generally hit all the sub regional economic entities of Sub Saharan Africa (West African Economic and Monetary Union, ECOWAS, SADC, etc).

Heavy reductions of rice and wheat supply were noticed on the world market. In parallel to this supply drop, the costs of inputs increased rapidly. The fertilizers price was thus multiplied by three within one year (January 2007 – January 2008).

In 2007, the FAO index of the food stuff prices was on average higher than 23% compared to that of 2006.

The increase of the staple food products was directly felt on imported rice, local rice, maize and refined oil. Thus, the kilogram of great consumption rice went from 250 CFA Francs (January 2008) to 400 CFA Francs (end of March 2008); or an increase of 65% within three months.

Faced with this situation, the Government of Senegal took a certain number of protective measures by reducing the Value-Added Tax, by subsidizing fertilizers and seeds, and by placing security stocks in the vulnerable zones. These measures enabled to decrease the prices of staple food products, but they were not sufficient to absorb the cereal deficit. Although the national production of whitish rice doubled, going from 150,000 to 350,000 tons (+130%), it did not enable to slightly reduce rice imports which are presently 600,000 tons.

It is worth specifying that agriculture still remains one of the main sectors of Senegal's economic activity. It occupies more than 65% of the population but its share in the GDP is low (5.9% in 2007). This low agricultural performance is explained largely by the rainfall deficit, the farms productivity, and the bad quality of seeds. And yet modern agriculture depends heavily on the use of different inputs particularly chemical fertilizers, pesticides and improved seeds. Contrary to fertilizers and pesticides, improved seeds are rarely available. The chemical inputs and the modern production techniques are certainly important in agriculture but their effects would be insignificant if good seeds were not used. According to FAO (1998), the good quality of seeds contributes itself to about 40% in the yields increase.

The difficulties of access to seeds and selected plants were often identified among the major constraints to the improvement of the production systems productivity. Many causes are put forward, particularly : (i) a non adapted seed mechanism characterized by a poor management of the system of national production of cereals' seeds, particularly foundation seeds ; (ii) a centralized organization that does not take into account the needs of traditional agricultural which nevertheless produces more than 90 % of the agricultural production ; (iii) an absence of information on the available stocks and the farmers seed requirements due to the persistence of the barter system, and the absence of tangible relationships between the different actors of the seeds sub sectors) ; (iv) the absence of crop credit and agricultural inputs ; (v) a lack of seeds' specialists and (vi) a low importance given to the seed sector in the national policies and agricultural strategies. In most development projects, the seeds component is often overshadowed. Otherwise, it is integrated as an activity oriented towards meeting the seed requirements of intensive agriculture. The needs of small agricultural holders are not taken into account even if they constitute the target group.

This means that the low use of selected seeds arises in terms of appropriate strategic programs to be implemented in order to increase agricultural productivity, and to reach food security.

To remove these main constraints agricultural development constraints, Senegal voted in May 2004 the Loi d'Orientation Agro-Sylvo-Pastorale (LOASP) – Agro- Sylvo- Pastoral Orientation Law -- which sets the framework for agriculture management in the medium and long term. This law organizes the rural actors' professionalization by giving a legal aspect recognized and protected to the agriculture works, the production units (agricultural farms), the producers' organizations and the inter-professions. It fits under the country's macro-economic policy which builds on the Poverty Reduction Strategy Document (PRSD) which aims at creating the enabling conditions to a sustainable growth and an efficient poverty control. The PRSD takes into account the sector and decentralized policies and perfectly integrates into the country's development tools. It gives a priority to agriculture in a wealth creation vision.

Accompanying measures related to the actors' capacity building are implemented through a National Fund of agro-sylvo pastoral development. For this purpose, the "Programme National de Développement Agricole" (PNDA) – National Program of Agricultural Development - constitutes an interesting alternative.

Despite the far from brilliant description of the seeds sub sector, it is worth noting the considerable progress recorded these past years on irrigated rice in the Senegal River Valley. The situation is much more delicate in the other regions of Senegal and the farmers always have recourse to seeds taken from their harvest, or to the stocks of seeds sold by the traders. These stocks over time often lost some of their variety purity and sometimes even, some of genetic vigor. But they constitute in many cases the only and unique recourses.

In relation to this situation, different attempts were nevertheless initiated by the Senegalese Government to ensure the boost of the seeds' activities, but they mostly had limited success. In addition, with the actual increase of the demand of food crop-based bio-fuels (sugar, maize, cassava, oil producing plants, and palm oil), and the prices explosion of food stuff at the world level, there is a real threat of disappearance of the farmers' stocks. In these conditions, a comprehensive analysis of the seeds issue must be conducted and appropriate solutions but adapted to the new stakes must be proposed to the Government of Senegal. For this purpose, the « value chain » analysis was chosen as a tool which can enable a better understanding of the seeds' constraints and opportunities. It complements the Senegalese Government's will to make the Senegalese agriculture the engine of economic and social development through certain projects as the Plan Retour à l'Agriculture (REVA) - Return Plan to Agriculture, the Programme National d'Autosuffisance en Riz (PNAR) – National Programme in Rice Self-sufficiency, and the Grande Offensive Agricole pour la Nourriture et l'Abondance (GOANA) – Big Agricultural Offensive for Food and Abundance --, initiated in response to the prices explosion of the food stuff.

This will of the Government of Senegal is also translated into an improvement of the regulatory framework of the producers' organizations which gives a new dimension to the associative movement.

2.2 Evolution of the cooperative movement

The organization type put in place during the first independence years is the most wide-spread cooperative system. However, it frayed over time following a series of draughts for more than twenty years, which much influenced the cooperatives' performances. Most of these cooperatives ended disappearing due to debts.

Faced with the crisis importance, the Government restructured the cooperative movement by promulgating in 1983 the law 83-07 and the decree 83-320 giving rise to the Nouvelle Politique Agricole (NPA) – the New Agricultural Policy. The establishment of the NPA was brutal and had serious consequences on the cooperative movement that was not ready for this change which main action was the Government's disengagement from market functions, particularly: (i) the stopping of the cooperatives supply of equipments and agricultural inputs; (ii) the dissolution of the Banque Nationale de Développement du Sénégal (BNDS) – Senegal's National Development Bank (iii) the elimination of the Office National de Coopération et d'Assistance pour le Développement (ONCAD) – National Office of Cooperation and Assistance for Development--, in 1980, the SONAR then the SONAGRAINE later in 2001. One exception to the NPA was the creation in 1982 of the Caisse Nationale de Crédit Agricole du Sénégal (CNCAS) – Senegal's National Bank of Agricultural Credit, despite basic diagnostic studies unfavorable to the opening of new structures of agriculture financing. The CNCAS was created with the mission to promote the provision of agricultural inputs and equipments to the farmers.

By instituting the law on the GIEs (economic interest groups) and that related to the credit unions, the NPA favored the diversification of the types of farmers' organizations (see annex 1).

2.3 Characteristics of the farmers' organizations

The disappearance of cooperatives gave a hard blow to the Senegalese associative movement in favor of the GIEs and the farmers' organizations which were mostly informal and not very stable structures.

According to the big agro-ecological zones and the territorial level (national, regional, departmental, community, village), several types of farmers' organizations were inventoried (see Table 36).

III. REVIEW OF THE SEEDS SECTOR

3.1 Background of the seeds sub sector

The study of Senegal's seeds sub sector reveals the following main periods:

- **Period I (before independence):** It especially concerned the development of the Sociétés Indigènes de Prévoyance (S.I.P) – Indigenous Companies of Contingency Fund which objective was to supply the producers with peanut seeds. Due especially to their authoritarian management, these Companies experienced organizational changes which marked the functioning of the seeds system. The seeds conservation and distribution as well as the provision of fertilizers and equipments within the liberal cooperative of 1947, then at the level of the adapted cooperative of 1955, -- were ensured by the mutual companies of rural development.

In parallel to that, research was conducted in the area of selection and dissemination of the new varieties. However, it was slowed down during the Second World War (1939 - 1945). Nevertheless, a variety map was developed in 1947 and updated in 1952 and 1960. In addition, the dissemination of the peanut variety 47-16 started from 1958.

- **Period II (1960 – 1970) :** It concerned the strengthening of the organization of the rural areas with the creation of infrastructures of storage and distribution of agricultural inputs dubbed « *seccos* » which were installed by the Centres Régionaux d'Assistance pour le Développement (CRAD) – Regional Assistance Centers for Development and the ONCAD (National Office of Marketing and Assistance to Development). These two structures favored in other respects the producers' access to inputs (seeds, fertilizers) and to agricultural equipments. This period established the advent of the Sociétés Régionales de Développement Rural (SRDR) – Rural Development Regional Companies, and the technical support/advisory services to rural areas. These companies played an important role in disseminating the varieties through the SAED, the CFDT/SODEFITEX, the STN, the ILACO/PIDAC/SOMIVAC, etc.

The period was also characterized by the start-up of a real production of certified seeds with the creation in 1972 of the national seeds department. Thus, in addition to peanuts, the main crops (millet, sorghum, maize, cow pea, rice) henceforth benefitted from sector seeds' programs. The Government's intervention through its technical structures particularly research, departments of seeds control and certification, and the SRDRs, -- was strong enough.

During this period, the Government took in charge the overall management of the activities of seeds' production and marketing. The requirements in certified seed requirements seeds of the main crops, determined by the SRDRs, were generally covered by specific seeds multiplication programs.

The period was marked by an important indebtedness by the different partners of the agricultural sector, compelling thus the Government to reduce its intervention.

- **Period III (1980 – 1990):** It was marked by the Government's disengagement from the activities of seeds production and marketing and the liquidation of several companies which ensured the seeds' functions. These were particularly the Projet Maïs - Maize Project, the Projet Semences Légumières - Vegetable Seeds Project (PSL) and the Projet Autonome Semencier (PAS) - Autonomous Seeds Project.

One of the accompanying measures of the Government's disengagement was the advent of the Union Nationale Interprofessionnelle des Semences (UNIS) – National Inter-professional Union of Seeds. L'UNIS was supposed to accelerate the seeds sub sector's privatization. Important programs were implemented for four years with the PAS support. However, when this project was closed, its results were still insufficient qualitatively as well as quantitatively. Only irrigated rice could have an

operational mechanism with an average production of 2,500 tons of seeds ensured by the UNIS-Zone Nord. The seeds of diversification crops (rain-fed rice, maize, millet, sorghum, cow pea, and peanut) dropped considerably.

- **Period IV (from 1990 to present):** It is characterized by the dismantling of the UNIS into two entities - UNIS and UNAOPS. This situation considerably weakened the inter-profession as well as its capacity to cover the national seed requirements, and local initiatives were then developed. Thus, producers' groups were trained in seeds management (production, collection, processing, storage and marketing) to evolve afterwards in SPO². The ANCAR, in partnership with other actors (ISRA, DA/DISEM, POGV, and ASPRODEB), provided support to these initiatives through the development of community seeds programs. It was the same for NGOs such as World Vision, CARITAS, Catholic Relief Service (CRS) and RADI which were very active in the seeds sector through the emergency programs.

3.2 Status of the seeds sector

Generally, several seeds' systems are used to ensure the rural areas supply with certified seeds. However, they mostly encounter various difficulties of structural, technical and financial order which are translated into:

- A disorganized intervention of several actors evolving upstream the production;
- Difficulties for the different actors of the segments to plan the user requirements ;
- A lack of organization and communication on the seeds marketing ;
- Difficulties to control the costs of collection, processing, and transaction, making the seeds sale price inaccessible for the producer ;
- Low productions of certified seeds;
- A use by the Government of « mixed seeds » to build up again the seeds stock ;
- A low level of fertilizers use leading too low yields particularly for the food crops (maize, millet, sorghum, cowpeas, rain-fed rice) ;
- Difficulties to reimburse crop credits.

At the strategic orientations level, major problems are noted in the different seeds' programs. These problems are translated into:

- A low use of selected seeds (less than 5% only for rain-fed rice, maize, millet, sorghum and cowpeas) despite the availability of improved varieties ;
- Technical and financial means deployed essentially for building up again the seeds stock of peanut and of a few special programs on maize, cassava, sesame with the establishment of « mixed seeds » used as seeds. However the other food crops (millet, rain-fed rice, sorghum, cowpeas) which play a determining role in food security, do not presently benefit from substantial support;
- the absence of accompanying measures for the promotion of certified seeds which ended to be used for food consumption or sold to certain NGOs and in the neighboring countries ;
-

² SPO : Seeds Private Operator)

- the quasi-inexistence of professional organizations of certified seeds capable of taking over research, and having an organizational and financial framework likely to accompany them in the area of certified seeds production ;
- The anarchic introduction of non approved seeds, contrary to the provisions of articles 12 of chapter III, 2 of the decree 97-603 and of the decree 97-616 ;
- Weak imbrications between the institutions. The transfer mechanism of technologies between the different partners (research, extension, private sector and seeds' producers) is not operational ; this poses problems at all levels of the process of variety experimentation, farm tests, demonstrations, approval of varieties, and establishment of seeds programs ;
- A drop of the technical capacities of seeds' producers as well as the deferment of the producers' training and retraining.

Despite these constraints, Senegal still has unquestionable assets. They particularly concern good genetic potential constituted by improved varieties of various species adapted to the country's different agro-ecological zones. In addition, it has a legal and regulatory framework governed on one hand by law n° 94-81 dated December 23, 1994 related to the varieties registration, the production, the certification of seeds and plants, and on the other hand, by three decrees:

- Decree 97-602, establishing a directory of species and varieties of plants cultivated in Senegal ;
- Decree 97-603 concerning the creation of the Comité National Consultatif des Semences et des Plants (CNCSP)- National Advisory Committee of the Seeds and Plants ;
- Decree 97-616 concerning the regulations of the production, certification and trade of the seeds and plants.

These national regulations, reinforced by the implementation of the harmonized seeds framework of the sub regional entities (ECOWAS, WAEMU, CILSS), could promote the development of the seed industry as well as the private sector intervention, and facilitate exchanges of seeds between Senegal and the other Sub Saharan countries.

3.3 Methodology and organization of the study

The methodology used includes: (i) a literature review; (ii) field trips; (iii) market studies, and (iv) an analysis and a validation of the value chain.

The literature review consisted of reviewing different value chain analyses available at the SAGIC/EGP project level. These analyses particularly concerned bissap, mangoes, neem, textile and milk sub sectors in Senegal, cotton in Kenya and sorghum in Mali. Several project documents of the Ministry of Agriculture on the seeds sub sector were reviewed.

An interview guide according to the target was developed. Field trips were afterwards undertaken in the main food crops producing zones in order to better understand the seeds' systems operation in the different production systems particularly in: Bambey, Diourbel, Fatick, Kaolack, Kaffrine, Kounghoul, Kolda, Saint-Louis, Sédhiou, Touba, Vélingara (Anambé Basin) and Ziguinchor.

In all these zones, discussions were held with the main users who were particularly the farmers, the seeds private operators, the traders, the GIEs' members, the NGOs and the banks officials, etc. Several meetings were held with ISRA and ANCAR managers, the DRDRs, the SDDR, the CSA and the SAED delegation of Dagana.

At the end of the field trips, operating accounts were developed for each user of the seeds chain. The domestic resource cost (DRC) of these different segments was calculated in order to better decide on the economic and financial cost-effectiveness of the seeds production.

The DRC is a tool to measure the comparative advantage of a given system. It represents the ratio between the cost of the local inputs consumed to produce a good and the revenues obtained minus the costs of the tradable inputs. This ratio can be interpreted as a proportion of the local inputs cost over a margin. If this ratio is higher than 1 ($DRC > 1$), this means that the opportunity cost of the domestic resources use is higher than the value added at the world price. This means, in other terms, that the production system is not economically cost-effective.

Discussions were also held with the members of the SAGIC/EGP team, and essentially concerned the: (i) importance of the value chain analysis of the seeds sub sector in Senegal ; (ii) characteristics of the seeds market; (iii) opportunities of value added creation, and (iv) intervention opportunities of the private sector.

At the end of the study, a meeting to validate the main recommendations of the study was organized on August 2, 2009 at the SAGIC/EGP headquarters.

IV. TECHNICAL ANALYSIS OF THE SEEDS CHAIN

4.1 Value chain concept

The concept was created and described by Michael Porter in 1986 through its book entitled « the competitive advantage » following the principle that the value chain enables on one hand, a breakdown of the enterprise activity into sequences of elementary operations, and on the other hand, an identification of sources of potential competitive advantages.

According to Porter, the value is the amount that the clients are ready to pay in order to obtain the product offered to them. This value results from different activities conducted by the suppliers, the firm and the distribution channels (whether or not they are integrated into the firm). Within this aggregate, M. Porter seeks to identify the essential aspects of value creation so as to surround the modalities enabling to obtain a competitive advantage » (Gervais, 1995). It distinguishes the value generating activities in the main activities from the support activities.

The main activities cover all the activities which were conducted from the products development to their sales, including transportation to the clients and the provision of after-sales service. Regarding the support activities, they complement the main activities, and cover the:

- Procurement of production means (supply) ;
- Provision of technologies (research and development of technologies directly associated with the products and the production processor support activities) ;
- Human resources management (recruitment, capacity building of the human resources, etc.);
- Administrative activities essential for the good functioning of the entire value chain. They form what the author calls « the firm's infrastructure », i.e.: the: senior management, planning, finance, accounting, external relations, and quality management.

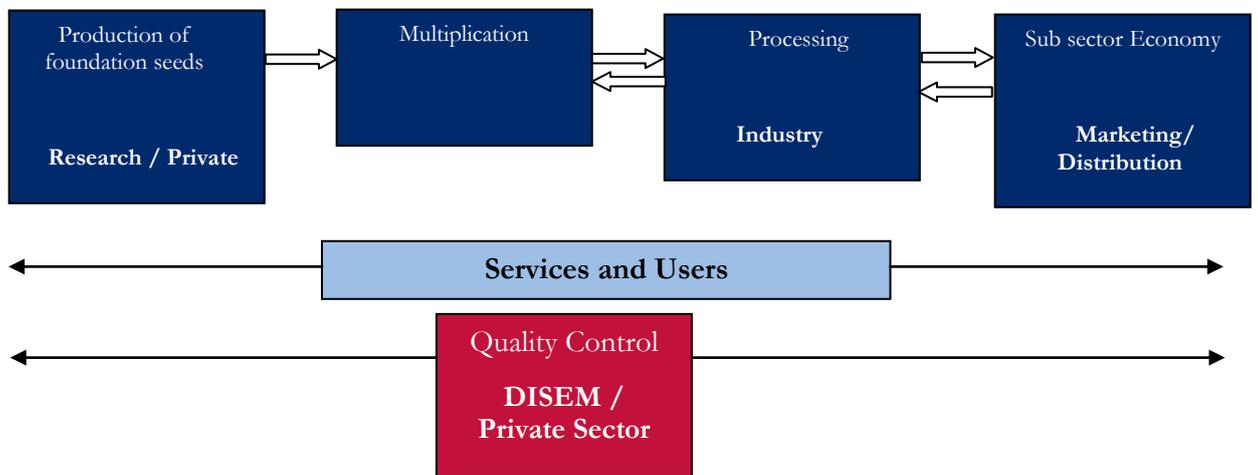
The value chain as described is thus a tool of complete diagnosis of the competitive advantages of a product or a given sub sector. It enables to conduct a detailed analysis by providing specific information on the operational structure of the sub sector as well as its functioning, and by identifying its main actors, the market prices and the demand at the local and national markets in order to propose global but targeted recommendations.

In the case of this present study, the recommendation must draw strategic options destined to increase productivity, efficiency and profitability of the cereals' seeds chain.

The value chain analysis must globally lead to a better capitalization of the investment opportunities in the seeds chain, particularly regarding the element of quality, economic and technical reliability, the volumes sold and their traceability. All these elements are important because they give a clear idea about the efficiency of the production network, the marketing and the seeds distribution. They bring out markets technical, economic and financial opportunities and therefore, and Senegal's assets to facilitate a solid seeds value chain, capable of improving competitiveness of its agricultural production in a sustainable manner.

4.2 Structuring of the chain

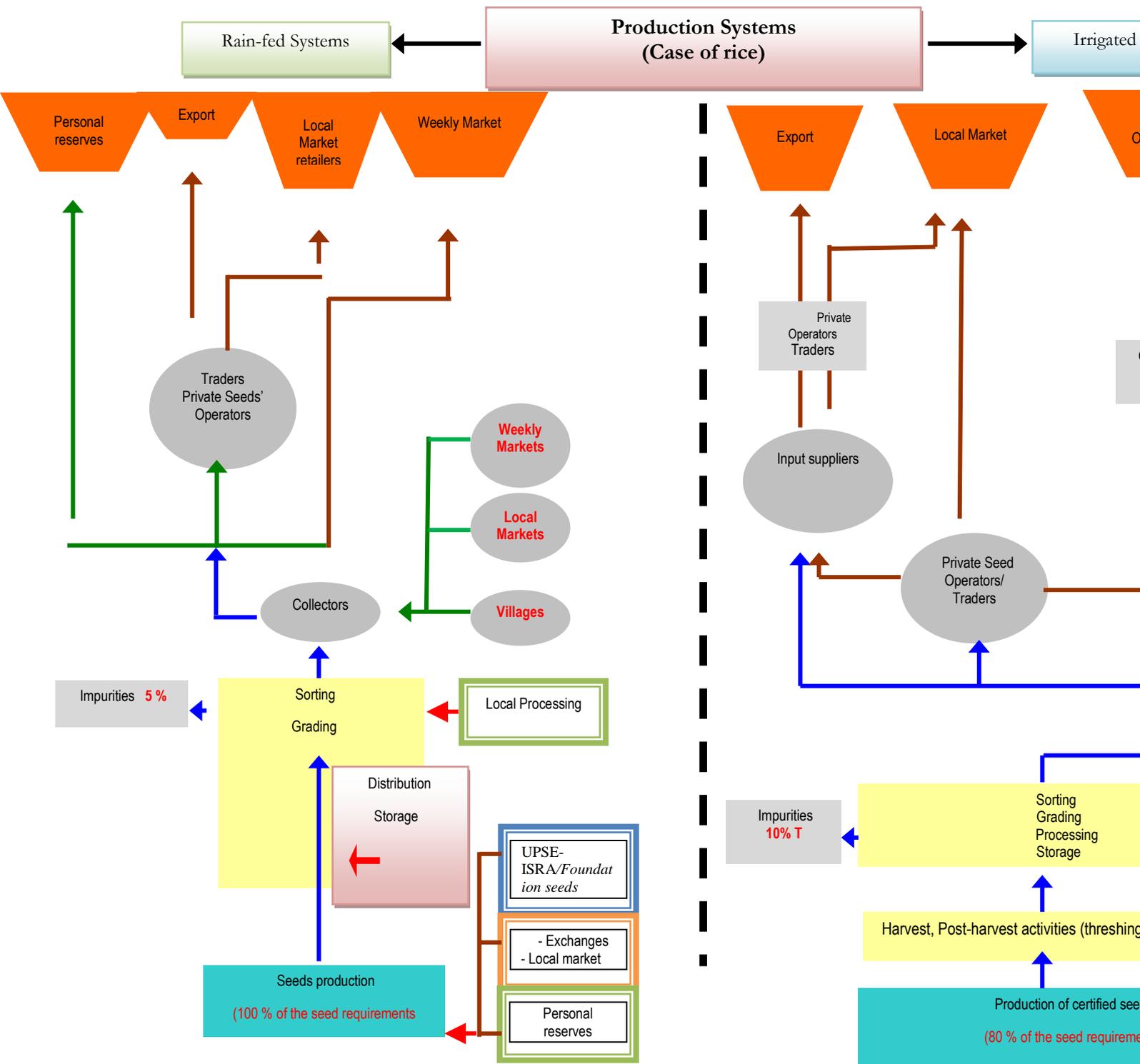
The seeds value chain analyzed below includes six main segments:



Taken individually, these segments cover various aspects which are indicated below:

Ecosystems	Production of foundation seeds	Production of foundation end certified seeds	Industrial phase	Sub sector economy	Quality control	Services
			Processing	Marketing/ Distribution	DISEM / Private sector	Users
Irrigated systems (rice, maize)	<ul style="list-style-type: none"> - Conservation and maintenance of the germ plasma - Production of foundation seeds 	<ul style="list-style-type: none"> - Certified seeds, Self production, Mixed seeds - Chain structuring (Big, Medium, Small producers) 	<ul style="list-style-type: none"> - Processing Centers - Pricing structure - Determination of processing costs - Volumes - Processing costs of foundation and certified seeds 	<ul style="list-style-type: none"> - Pricing structures - Actors' organization / Inter-professions - Distribution network - Sale costing - Turnovers - Local sale - External sale - Traceability 	<ul style="list-style-type: none"> - Quality control - Intervention of registered technicians - Traceability 	<ul style="list-style-type: none"> - Inputs - Credit - Transportation - Storage
Rain-fed systems (rice, millet, sorghum, maize)	<ul style="list-style-type: none"> - Conservation and maintenance of the germ plasma - Production of foundation seeds 	<ul style="list-style-type: none"> - Self production, Traditional varieties, Mixed seeds, Certified seeds, Farmers' reserves - Chain structuring (Big, Medium, Small producers) 	<ul style="list-style-type: none"> - Local processing /farmer - Processing centers - Pricing structure - Volumes - Processing costs 	<ul style="list-style-type: none"> - Exchanges, Grants, Loans, Marketing - Pricing structure - Actors' organization / GIEs - Distribution networks - Sale costing - Turnovers - Local sales - External sales 	<ul style="list-style-type: none"> - Trust 	<ul style="list-style-type: none"> - Inputs - Loans - Transportation - Storage

The seeds chain is presented in a schematic manner as follows:



Grand transport routier

4.2.1 Segment of foundation seeds production

This segment covers the following activities: variety selection, conservation of the germ plasma, production of foundation seeds and basic infrastructures.

4.2.1.1 Variety selection

The variety selection made important progress over time in the area of genetic improvement of the main cultivated species.

Thus, there exists in station a large array of improved varieties adapted to the country's different agro-ecological zones. These varieties mostly meet the users' expectations because they integrate the main concerns of the producers, industrials and consumers. These concerns are identified after permanent participatory diagnoses organized by ISRA in relationship with the development partners and destined to regularly update research activities.

The varieties used in Senegal essentially come from autogamous species (rice, sorghum, peanut, cowpeas...) or pollinated species (maize, millet...). The hybrid varieties on the other hand are still not very well accepted.

The autogamous species originate from genetically stable strains and are therefore demanding in the area of renewal of the basic kernels and in conservation. Regarding the pollinated species, their management is more delicate because they come from the populations.

In parallel to the improved varieties, ISRA also maintains in station local ecotypes coming from the collections organized in rural areas, and from accessions of local cultivars introduced from genes' banks of international agricultural research centers.

Main constraints in the area of variety selection and improvement

Several constraints affect the Senegalese variety selection performances. Among those, the following aspects are noted:

- 1) The non-functionality of the system of variety approval and registration. If it was not because of the approval of rice varieties Nerica 1 and Nerica 6 in 2009, one would be tempted to believe that in the case of rice for example, this procedure only took only place every 10 years (1987, 1997 and 2007). For 1997 and 2007, several varieties were approved. They are:
 - **1997** : DJ 8-341, DJ 11-09, DJ 12-159, DJ 684-D, Tox 728-1, ITA 123, BR 1-56-5, BG 90-2, BW 248-1, IR 1529-680-3, WAR 1, WAR 77-3-2-2, WAR 81-2-1-3-2, ROK 5
 - **2007**: Sahel 159, Sahel 134, Sahel 208, Sahel 209 and Sahel 210.
- 2) The absence of a regulatory framework of the DHS criteria evaluation (Distinction, Homogeneity, and Stability) and VAT (Agronomic and technological values) instituted by ministerial decree; the non-existence of a Permanent Technical Committee charged with evaluating the varieties;
- 3) The absence of funding to conduct the DHS tests and the VAT in conformity with the decree instituting the varieties directory ;
- 4) The non programming and non declaration of the production activities of the foundation seeds by research ;
- 5) The low investments in variety selection on private funds. Only the company TROPICASEM is an exception to that thanks to its program of vegetable varieties creation ;
- 6) The absence of firm orders which does not facilitate the programming of the production activities;
- 7) The low profitability for producing the foundation seeds of the food crops ;
- 8) The under-equipment of the stations producing foundation seeds;
- 9) The loss of research technical skills. ISRA lacks staff mastering seeds technology. This is partly due the massive departures of researchers towards national institutions (ANCAR, ASPRODEB, local

- 10) NGOs, etc.) or international NGOs (AFICARE, ICRISAT, WINDROCK, etc.). All ISRA's specialists in seeds technology departed towards other directions and were never replaced ;
- 11) The big diversity of species is covered by ISRA, the only organization producing foundation seeds in Senegal for all the main crops (millet, sorghum, maize, rice, cowpeas, peanut, etc).

Despite the constraints mentioned above, ISRA continues to play a major role in the maintenance and dissemination of the improved varieties. It aroused much interest from the international community. This interest needs be reinforced by putting at the disposal of researchers, adequate working tools as well as incentive allowances to retain them within the institution.

On this last aspect, the strengthening of the partnership with the private sector, particularly in the phase of pre dissemination and dissemination of technologies and the paying back the copy rights, -- could be of a great contribution.

The status of EPST (Etablissement Public à Caractère Scientifique et Technique) - Public Institution of Scientific and Technical Nature - of ISRA seems here not to be very valued. In fact, this status enables to exploit the motivation mechanisms such as the « *Sign-off* » used by the European research institutions. Through this system, the researchers could receive dividends thanks to an improved status of their inventions by the private sector which is better placed than ISRA to create value added. By the same occasion, the private institutions could be encouraged to invest in the area of variety selection.

Other motivation modes used in the sub region could serve as references. In Mali for example, the researchers are authorized to do consulting; the important thing is that they look after the institution' major interests. In addition, they are encouraged to remain members of their basic structures even if they hold positions abroad. For this purpose, a certain percentage of the researcher's new salary (about 10%) is deducted, whereas his/her basic salary is kept. These conditions facilitate the researchers' return to their structures of origin whenever necessary.

ISRA benefits from the expertise and know-how of several French research institutes, American and Canadian universities, former Eastern countries, and international agricultural research centers, which enable it to have improved varieties adapted to the country's soils and climate conditions. These varieties are used for the implementation of the programs for producing seeds of the main food crops in all the agro-ecological zones of Senegal. The particular case of the arid zones of the Louga region or salted zones of Casamance shows the importance of this collaboration in the mastery of the production systems.

The main varieties recommended by research for the different species and agro-ecological zones are:

Rice varieties

The Senegalese varieties directory is essentially constituted by introductions for the irrigated systems (Jaya of India, IR 15-29 and Sahel 108 of IRRI (Philippines), Sahel 201 of Sri Lanka, Sahel 202 of IITA (Nigeria), etc.). These varieties are generally characterized by a short straw, a good response to irrigation and sunshine, crops maintenance and fertilizer application. Their production levels can sometimes exceed 12 tons per hectare.

Table 2: Main characteristics of the disseminated irrigated rice varieties

Varieties recorded in the official directory	Name of dissemination	Recommended areas of cultivation	Duration of the sowing - maturation cycle (days)	Potential yield (Ton/Ha)
JAYA	JAYA	Senegal River Valley and southern Zone	125	8
IR 15 – 29	IR 15 29	Senegal River Valley and southern Zone	135	9
IR 13 – 240	SAHEL 108	Senegal River Valley and southern Zone	105 - 117	10
BW 293 – 2	SAHEL 201	Senegal River Valley and southern Zone	121 - 142	11
ITA 306	SAHEL 202	Senegal River Valley and southern Zone	117 - 139	11
IR 32307 – 107 – 3 – 2 - 2	SAHEL 159	Senegal River Valley and southern Zone	109 - 130	10
IR 31851 – 96 – 2 – 3 – 2 - 1	SAHEL 134	Senegal River Valley and southern Zone	110 - 132	10
ITA 344	SAHEL 208	Senegal River Valley and southern Zone	125 - 145	12
ECIA 31 – 606	SAHEL 210	Senegal River Valley and southern Zone	125 - 141	12
Tox 3241 – 22 – 3 – 3 – 1	SAHEL 209	Senegal River Valley and southern Zone	126 – 140	12

The main local creations especially concerned rain-fed rice cultivation particularly the series of the varieties DJ obtained in the stations of Séfa and Djibélor (Santo - DJ 8-341, Ewaro - DJ 11-509, DJ 12-159 and DJ 684 D). These are early varieties and present a good adaptability to water stress and a good resistance to diseases such as the pyriculariose and the scald.

Under rain-fed conditions, particularly in the southern zone (regions of Ziguinchor, Kolda and Sédhiou), the improved varieties used, are the following:

Table 3: Main characteristics of the disseminated rain-fed rice varieties

Ecosystems	Disseminated Varieties	Cycle (days)	Potential yield (Ton/Hectare)
Mangrove	WAR-1, WAR-77, WAR-81, ROK-5	135 – 140	4
Plateau	DJ 8-341, IRAT 10, DJ 11-519, NERICA-1, NERICA-6	100	3 – 4
Water table	DJ 12-519, IR 1529, Sahel 108, Sahel 201, TOX 728-1	105	4 – 6
Lowlands	DJ 684-D, IR 1529, BW 248-1, ITA 141, ITA 123, BG 90-2	120 - 130	6 - 8

Maize varieties

Table 4: Main characteristics of the disseminated maize varieties

Varieties	Areas of production	Cycle (days)	Potential yield (Ton /Hectare)
Synthetic C	Central South, Central East, South and North	90	4 – 7
Early Thaï	— // —	90	3 – 4.5
QPM	— // —	100	4 – 7

Millet varieties

Table 5: Main characteristics of the disseminated millet varieties

Varieties	Recommended areas	Cycle (days)	Potential yield Ton /Hectare)
IBMV 8104	Same area than SOUNA 3, of preference on sandy soils of <i>dior</i> type Diourbel, Central Thiès, North of Fatick, Kaolack -« -	85-95	2.5 – 3.5
IBV 8001		75-85	2.5 – 3
SOUNA 3	South of the regions of Thiès, Kaolack and region of Tambacounda	85-95	2 – 2.5
IBV 8004	South of Louga and Diourbel, Central Thiès, North of Gossas	75-85	2.5-3

Sorghum varieties

Table 6: Main characteristics of the disseminated sorghum varieties

Varieties	Recommended zones	Cycle (days)	Average yield (ton/hectare)
CE 151 - 262	North and irrigated North Zone	90	4 – 7
CE 180 - 33	Central North	100	3 – 5
CE 145 – 45	Central North and Central South	95	4 – 5
F2 – 20	Central South and South-East	110	4 – 5

4.2.1.2 Production of foundation seeds

Tables 7, 8 and 9 give a situation of the evolution of the foundation seeds production of the UPSE over the period 2006 - 2008. Their analysis revealed that decreases in production were recorded for maize, millet and sorghum. These drops seem to be explained partly by large scale dissemination by the Government of « mixed grains » at subsidized prices. On the other hand, there is a neat increase for the varieties of cowpeas which certified seeds are not bruchée contrary to the « mixed grains ».

Table 7: Production of maize foundation seeds

Foundation seeds G3	2006	2007	2008
Early Thai	11,091	1,491	924
Synthetic C	4,639	607	151
Swan1 (Goor Yombal)	4,741	0	200
DMR ESR W (Domer)	870	395	185
TZEE Y (Sorore)	0	0	168
TZEE W (Gawna)	2,025	1,809	443
Ac. 95 Pool 16 DR Xeeweul Gui	0	0	165
Syntetic 93 43 (Jaboot)	0	0	115
Obatampa	0	0	65
Total	23,366	7,302	2,416

Table 8: Production of millet and sorghum foundation seeds

Foundation seeds	2006	2007	2008
<i>Millet</i>			
Souna 3	6,687	5,198	2,307
IBV 8004	0	0	1,059
Total	6,687	5,198	3,366
<i>Sorghum</i>			
CE 180- 33	994	4,515	4,550
CE 145- 66	994	2,500	511
CE 145 SCB	0	0	18
F2- 20	280	0	0
Total	2,268	7,014	5,079

Table 9: Production of cowpeas foundation seeds

Foundation seeds G3	2006	2007	2008
Mélakh	400	1, 832	3, 209
Mougne	80	620	145
Yacine	0	254	1, 770
58- 74 (fodder)		1, 233	291
Total	480	3, 939	5, 915

4.2.1.3 Conservation and maintenance of the germ plasma

In addition to the variety selection activities, ISRA ensures the maintenance and conservation of the germ plasma of the main varieties cultivated in Senegal as well as the local ecotypes. This work is allocated to the breeders who provide the start-up matter (still called initial matter, stumps) necessary to initiate any seeds program.

In other respects, the breeders look after the genetic purity of the vegetal matter which must not be subject to degeneration. For this reason, the matter must be always kept in a controlled environment where it can benefit from adequate preservation condition of its initial characteristics.

In practice, this activity experiences some difficulties associated with the departure of several breeders, the lack of adequate conservation infrastructures, and the absence of a real program of plant breeding resources. The cold rooms built during the period of 1980 – 1990 are no longer operational. The breeders are also brought to regenerate every year the third of the initial material. On this subject, it is worth reminding that the frequent regeneration of the stumps is costly but it can be also be a source of mutations because of pressure risks of selection conducted at this level.

The production of foundation seeds of the levels G1, G2, and G3, and sometimes of the foundation seeds G4, is conducted by the Unité de Production de Semences (UPSE) – Seeds Production Unit – of ISRA, from stools supplied by the breeders. This program is normally conducted according to the orders made by the users.

Considering the complexity of the seeds mechanism which involves researchers, government’s technical departments, producers and private individuals, productions were programmed each year, and a seeds program was developed. However, it is worth recognizing that these annual meetings had not been held for years.

In addition to the germ plasma, essentially constituted by stumps of the main disseminated varieties, the breeding lines and accessions managed by research, there is a dynamic conservation which is done by the sub sector users, who are particularly:

- Seed operators members of the UNIS who presently implement programs which have already benefited from the PAS experience;
- Seed multipliers supported by SODEFITEX under BAMTAARE’s crops diversification program;
- Seed multipliers supported by ANCAR, ASPRODEB, NGOs, etc. ;
- Producers ensuring seeds conservation in the form of personal reserves.

The certified seeds are generally kept at the processing centers level. They are generally subject to monitoring and quality control by the DRDRs and DISEM agents.

The seeds coming from the community programs are kept in cereals warehouses built by the village associations or under the PAS or other programs supported by the donors such as USAID, the European Union, the World Bank, etc.

4.2.1.4 Basic infrastructures

ISRA inherited from the PAS and the PA-CNIA logistical means and production infrastructures at the stations level of Bambey, Niour, Séfa and Ndiol. This was particularly composed of plowing, processing and storage equipments, vehicles, and a laboratory of seeds analysis.

In addition, ISRA receives from the Government and the development partners, a revolving fund to support the production costs of the foundation seeds, and to conduct variety tests in multiple locations for the approval of the best varieties.

Its seeds production unit is supported by an agricultural mechanization unit which ensures the plowing and crops maintenance, as well as the seeds harvest.

Despite these potentials and its strategic role, ISRA does still manage to ensure a regular of foundation seeds to the different downstream the production for several reasons already stated above but also, because of the seeds' farms degradation. Thus, the UPSE is often brought to produce its foundation seeds outside the research stations. Production contracts are then signed with seed producers.

The consequence of this is a non-mastery of the seed activity (losses of productions, low coefficient of multiplication...) which is sometime aggravated by a lack of confidence of certain users, vis-à-vis some contractual producers.

Furthermore, for lack of adequate maintenance, all the infrastructures acquired under the PAS to ensure the production, collection, processing, storage, conservation of the stools in cold room and the agents' mobility, - are no longer operational.

Thus, ISRA had to unwillingly change its seed strategy by evolving towards the production of seeds destined to meet the needs of few development programs, which beforehand pre-finance production activities.

4.2.2 Segment of multiplication of the foundation and certified seeds (R1 and R2)

The scheme of seeds production is generally the same everywhere. However, it comprises particularities which differ according to the mode of seeds multiplication: autogamous plants, pollinated plants, and plants with vegetative multiplication.

Among autogamous plants such as rice, the preservation of the varieties genetic identity is relatively easy to realize. To do that, series of successive multiplications are conducted from an initial matter, followed by the production of foundation, registered and certified seeds.

The risks of mixes are considerable among the pollinated plants. It is why the important enough distances of isolation are respected (for example the case of millet for which, the distances between two varieties can be 10 meters and more). Interlines of other species are then used.

Contrary to the foundation seeds which must be produced in the research stations and the registered seeds which are, in certain countries, multiplied in seed farms, the certified seeds are multiplied in rural areas by contractual farmers.

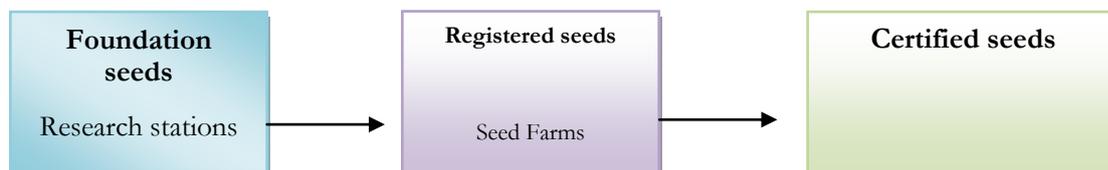
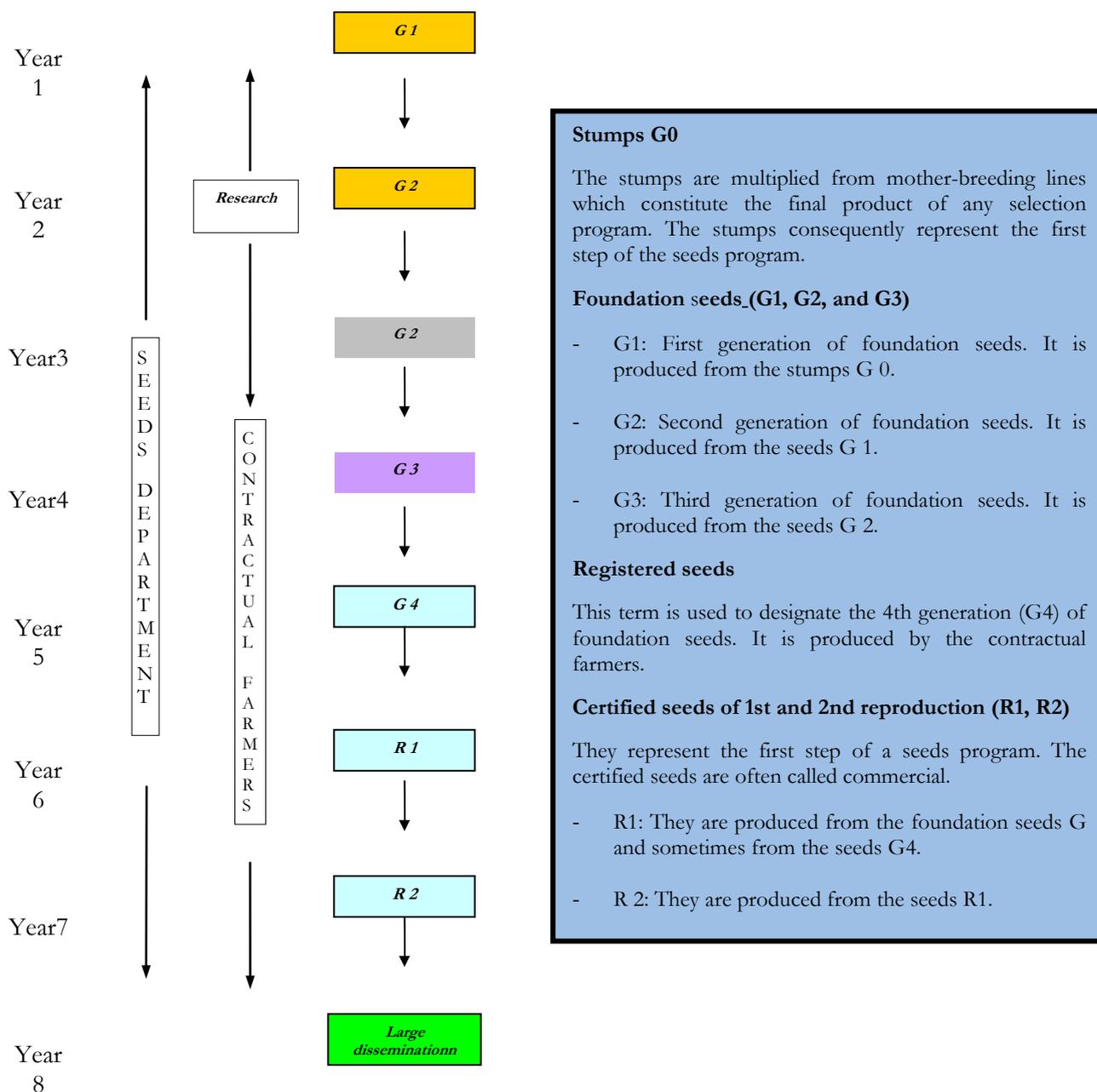


Figure 1: Main steps of seeds production of the **conventional** seeds system (case of rice)



Stumps G0
The stumps are multiplied from mother-breeding lines which constitute the final product of any selection program. The stumps consequently represent the first step of the seeds program.

Foundation seeds_(G1, G2, and G3)

- G1: First generation of foundation seeds. It is produced from the stumps G 0.
- G2: Second generation of foundation seeds. It is produced from the seeds G 1.
- G3: Third generation of foundation seeds. It is produced from the seeds G 2.

Registered seeds
This term is used to designate the 4th generation (G4) of foundation seeds. It is produced by the contractual farmers.

Certified seeds of 1st and 2nd reproduction (R1, R2)
They represent the first step of a seeds program. The certified seeds are often called commercial.

- R1: They are produced from the foundation seeds G and sometimes from the seeds G4.
- R 2: They are produced from the seeds R1.

4.2.3 Quality control segment

Field inspections and laboratory controls constitute the main control operations. Their objectives are to guarantee the quality of the seeds produced for the entire species and varieties. They are conducted during distinct periods:

- production
- storage
- marketing

Control operations are conducted under crop cultivation and on batches by the inspectors. They are completed by laboratory experiments. They enable to assure a good certification of the seeds.

The certification is conducted at three levels:

- variety
- technological
- sanitary

4.2.3.1 Variety, technological and sanitary certification

The variety certification enables to verify the genetic identity and the variety purity. It occurs after several crop cultivation controls. The technological certification is destined to bring out the variety's intrinsic characteristics, particularly the specific purity, the germinal faculty and the moisture rate. The sanitary certification is the result of controls under crop cultivation and in laboratory.

The controls under crop cultivation are often called inspections contrary to laboratory controls which are analyses.

The controls under crop cultivation are conducted by seeds' inspectors with a certain frequency determined according to the species. In general, the inspection team verifies several criteria including the following: environment of the seeds farm, seed's origin, previous crops, variety identity and purity, sanitary status of the crop, and respect of the production rules.

The isolation and purification techniques of the special types as well as the respect of the previous crops are well known by the Senegalese multipliers. However, the latter experience several difficulties to practice them. Certainly, the costs related to these operations as well as the ancient practices of associated crops, are the causes. Due to the absence of local productions of hybrid seeds F1, the producers ignore for example the techniques of emasculation, pollination or use of the sterile male line breeding. As a result, the practice of isolation and purification is only conducted under the constraint of the control departments. And yet, for some time, this pressure has been decreasing due to a lack of field agents.

This slackening concerns the plots' identification, the control-monitoring of the crops status and the isolation as well as the genetic purity and the sanitary status. The consequence is that often the multiplication plots are not identified. Even in Saint Louis where the certification system is more performing, the seeds' plots are not identified by signs.

It is worth reminding that the producer has to develop his/her planned program, and make his/her declaration of crop at the control department, so that its production plots can be inspected and recorded. In practice, there are considerable delays in the programming of the multiplications and the declaration of crops in relation to the due dates established in the particular technical regulations. Likewise, the national programming previously done, bringing together thus the producers' organizations, the holders and the controllers, and which was a mean of information and transparency in production, -- has no longer been done for almost twenty years now. The resuming of these days in 2009 by the Directorate of Agriculture is worth encouraging.

4.2.3.2 Control of the batches

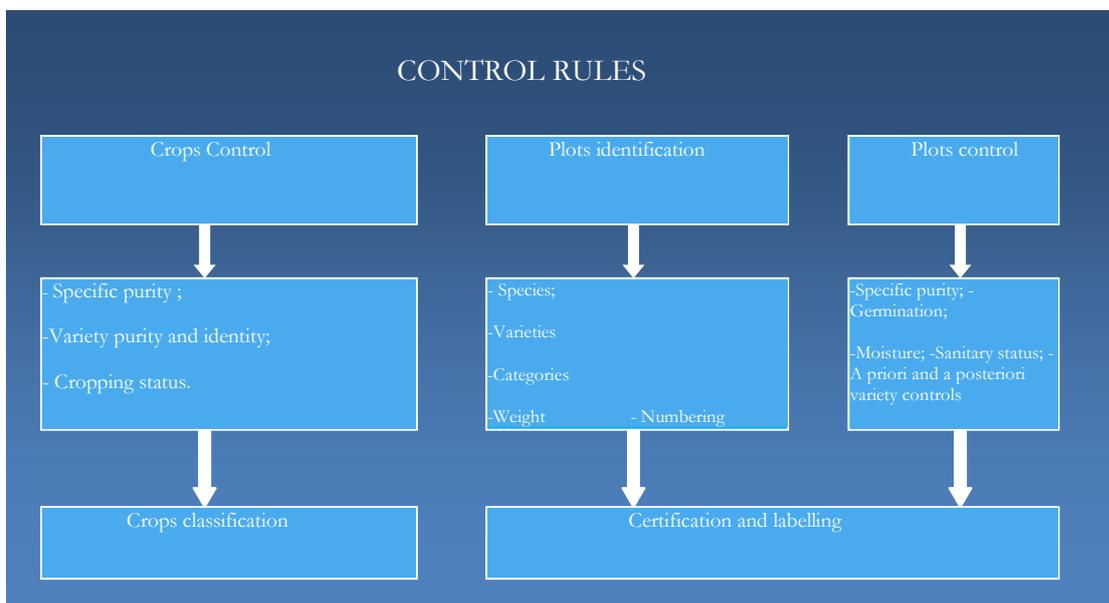
The batches control is conducted through taking samples on the crops at the farm level and during the certification. The batches and sub batches are differentiated by labels which indicate: the specie, the variety, the category, the processing product used and the producer's logo. On this subject, only the region of Saint-Louis applies a differentiation of the batches. However, the batches can sometimes come from plots or different farms; which poses traceability problems because the batch must be the product of one plot.

The verification operations of the genetic purity for the a priori control, no longer exist. They are worth being institutionalized at the level of the SOC (Service Officiel de Contrôle) – Official Control Department - representations to ensure a good traceability of the seeds' products and to enable to locate in time the batches with problems.

4.2.3.3 Laboratory experiments

Regarding the laboratory experiments, Senegal applies the ISTA (International Seed Tests Association) rules and its certification norms. The laboratory equipment put in place under a quality project funded by Spain must be made available to the regional laboratories.

Concerning the certification norms, it should be noted that the harmonization of the seeds regulations under the WAEMU enables the Senegalese organizations to operate on a larger market outside the national frontiers.



The quality control segment experienced constraints and management problems described in the background part reserved to the sector evolution. This situation created an administrative gap in the seeds mechanism of production of foundation seeds and certified seeds R1 and R2 at a period when expressions of seed requirements constantly increase.

Table 10 shows a certain infatuation of the producers for irrigated rice seeds. This infatuation is much more displayed on the R1 than the R2, and this is partly explained by an increase of the purchase of seeds R1 by the Mauritanian producers and those of the Anambé Basin. On the other hand, the local consumption of R2 constantly decreases.

Table 10: Production of commercial seeds R1 and R2

Year	Certified seeds			R1			R2		
	Ha	Yield	Tons	Ha	Yield	Tons	Ha	Yield	Tons
1990/91	22.80	2.34	53.40	334.37	1.63	546.12	86.30	0.88	76.24
1991/91	18.15	3.52	63.84	241.31	3.14	757.69	175.03	1.96	342.76
1992/93	19.60	3.34	65.40	387.43	2.23	865.60	154.33	0.86	132.62
1993/94	26.00	3.28	85.32	448.73	2.71	1,213.90	35.00	0.57	20.12
1994/95	101.70	1.70	173.11	586.00	0.46	269.27	405.21	0.45	181.28
1995/96	92.48	0.94	86.89	203.66	1.69	343.41	72.50	1.83	132.52
1996/97	31.74	2.69	85.27	568.90	1.89	1,073.94	135.02	2.28	308.36
1997/98	29.94	2.61	78.16	428.20	3.08	1,320.23	166.49	2.02	335.56
1998/99	14.41	3.10	44.60	306.37	3.74	1,146.90	120.55	2.13	256.94
1999/00	42.37	2.34	98.95	251.45	7.31	1,838.25	398.46	1.09	435.83
2000/01	45.96	4.52	207.53	428.85	2.64	1,131.86	166.78	3.60	599.60
2001/02	30.86	1.13	34.72	338.79	2.50	847.32	16.01	1.46	23.36
2002/03	19.38	6.00	116.31	225.89	4.80	1,084.28	24.21	4.80	116.24
2003/04	23.30	3.33	77.65	462.60	3.23	1,494.88	15.43	13.72	211.76
2004/05	9.16	6.00	54.96	479.61	6.00	2,877.66	63.24	3.87	244.44

In the case of rain-fed crops, there is no reliable data on the consumption of improved seeds. The farmers always have recourse to the donations, exchanges and sometimes, to purchases. It is under this context that several initiatives were developed including : the community programs, the intervention of the seeds private operators, the emergency programs and the massive exploitation of the farmers' personal reserves through seeds' fairs and commodity exchanges. These initiatives will be reinforced by the Government through the PNAR (Programme National d'Autosuffisance en Riz) – National Program of Rice Self-sufficiency - and the seeds' hubs Project.

The PNAR is a rice self-sufficiency program which overall objective is to bring the national whitish rice production to 1,000, 000 tons by 2012; which represents on average a production of 1,500,000 tons of paddy. The seeds' hubs project is at its feasibility stage, and its objective is to reinforce the seeds production in the Senegal River Valley, the Anambé Basin and certain ISRA seed farms.

To reach the production objective displayed by the PNAR, the project plans to bring the cultivated areas to 327,080 hectares of which 196, 080 in irrigated zone (Senegal River Valley and Anambé Basin). Outside this zone, rice production will essentially concern the regions of Tambacounda, Fatick, Kolda and Ziguinchor and should extend over 131,000 hectares.

4.2.3.2 Strategic alternatives

Community programs

These programs were built on the empowerment of the village communities to ensure and take ownership of the technology of production, collection, processing, conservation and sales of quality seeds from foundation seeds bought from ISRA.

Several community programs are used nowadays in Senegal. However, the approaches differ. They vary according to initiating institutions (ANCAR, ASPRODEB, Farmers' groups, etc.).

In the case of ANCAR, a grant in inputs is provided to the producers from the first year. In addition, the field technicians look after a good application of the recommended crop management sequence techniques. It is possible, through this system, to ensure the partial reconstitution of the seeds stock of CLCOP of several rural communities. However, it is difficult for the program to be sustainable.

From its side, the POGV designed and implemented a community program with an approach integrating downstream the creation of purchase stations which ensure the supply of inputs to the rural communities. They also ensure other socio-economic development activities desired by the populations.

The community program implemented by the GIE of Boundoum enables each year to make available to its members more than 300 tons of seeds destined in priority to cultivate some 3,000 hectares. Only the left over is sold abroad.

Production of certified seeds by the private operators

Despite the difficulties encountered by the UNIS, some private operators and GIEs, still credible vis-à-vis the banking system, implement programs of certified seeds production according to the official plan defined by the seed legislation. Among them, we note the following:

- In the Senegal River Valley : the GIE Delta Agrisol, the Etablissements Fall et Freres, Assescaw, the GIE Ndjion Kunda, the GIE Mama O. Niang, the GIE Natangué, the Union Mboudoum FPA, the Union Deby Tigueth, the Ujack de Podor, the GIE Coumba N. Thiam and the GIE El Hadj Malick Sy
- In the Anambé Basin: the GIE Rahmane
- In Ziguinchor : the Entente de Diouloulou
- In Nioro : Ousmane Thiam (Taïba Niassène)
- In Bambey: Cheikh Bara Guèye.

The production of certified seeds is also conducted by seeds' producers of ASPRODEB and SODEFITEX.

Under its support to the cotton producers, SODEFITEX, implements programs of maize seeds production under contract with seeds' producers. This work is performed through its rural development directorate dubbed BAAMTARE which organizes the collection, processing, storage and marketing of the maize certified seeds.

Emergency programs

NGOs such as World Vision, CRS, RADI and WINROCK intervene at this level by using different approaches. They provide important support integrating the entire sector's socio-economic aspects.

For example, CRS organizes seeds' fairs which help producers get seeds supply of good quality. These fairs are also the opportunity for the producers to sell their seeds without going through intermediaries as it is often the case at the weekly markets (loumas) level. This initiative experienced a certain infatuation but does not enable to halt the seed deficit.

Mini-kits and mini-doses

The mini-kits and mini-doses were essentially disseminated by the PROGES (Southern Zone Water Management Project) funded by USAID. They consisted on one hand of putting at the disposal of the producers crop management sequence techniques, including certified seeds and fertilizers, and on the other hand, of recovering the equivalent of the cost in kind of the crop management sequence techniques.

The mini-kits and mini-doses certainly enabled the producers to have access to the new varieties, particularly the WAR 1, WAR 77 and WAR 81. However, their success did not go beyond the project duration.

Personal reserves

The personal reserves of seeds are constituted by individual or collective stocks of seeds of farmers generally grouped into families. These stocks include improved varieties and traditional cultivars.

These practices have been always used for the seeds stock rebuilding. But they were disrupted by the years of draught which caused a drastic decrease of productions and consequently, of the levels of seeds collection.

4.2.4 Industrial processing segment (processing of the seeds)

During the harvest, the seeds contain many impurities (inert matters, seeds of harmful self-propagating weeds, seeds of other cultivated species or other varieties, and damaged seeds) which must be eliminated in order to improve their market qualities, and respect the characteristics required for the seeding.

The processing enables to efficiently conduct these operations. It represents the industrial phase of the certified seeds production. It is indispensable for the completion of the seeds certification process.

The processing consist of a series of successive and logical operations of ventilation and densimetry destined to remove the inert materials according to their weight, followed by grading operations in order to separate the grains according to their biometry (length, width and thickness). The product is then put in bags and treated with fungicide-insecticide.

4.2.4.1 Main processing steps

The processing can be divided into several well identified steps which follow a well precise sequence. The choice of these operations and the required equipment depend on the specie, the foreign bodies' nature, and the level of the desired market quality. The main processing steps are the: reception, pre-processing, ginning, trimming, pre- cleaning, basic cleaning, separation and grading, and chemical treatment.

Reception: After the weighing on the weighing bridge, the seeds are forwarded in bags or stored in bulk to the feeder of reception.

Pre-processing: It applies to the operations which come before the basic cleaning. It main concerns the: ginning, trimming, lumping and pre-cleaning.

- **Ginning:** This operation is generally only conducted in the case of maize which harvest is done in ears, when it comes to seeds. It is delicate and sometimes can cause as many damages as the other manipulations all together.
- **Trimming:** The essential objective of the trimming is to remove the filaments which extend the lemma of certain rice varieties. For these varieties also called barbate, the presence of beards before the basic cleaning could complicate the operations of sorting and grading as well as the selling of the seeds during the processing.

Trimming, like pre-cleaning, is costly and must only be conducted when necessary.

- Pre-cleaning is a rapid cleaning destined to eliminate the big losses (straw, fragments of plants, mounds of dirt, and gravels).

Pre-cleaning includes several advantages:

- a) It facilitates the seeds transportation by the conveyors, eliminates the too humid plant matters, and reduces the seeds drying time;
- b) It tends to improve the quantitative and qualitative yields of the following operations;
- c) It reduces the dust in the processing unit.

Basic cleaning: After pre-cleaning and drying, the seeds are subject to a top-quality review to eliminate the undesirable elements. This operation is conducted through the machine with fans and sieves. The seeds, by keeping on being inert, fall in the feeder in a feeding mechanism which outputs the batch of grains through a draught. The light and fibrous materials are taken away by the air and the remaining seeds are distributed in a uniform manner on the first dusting screen at the level of the higher sieves.

A second and third sorting are necessary. They are used to eliminate the fine losses and to calibrate the seeds, respectively. The seeds sorted with precision in this sieve go afterwards through an air handle which leaves the thick and dense seeds go down and deviates the light seeds, the wild grasses and the straw fragments in a compartment of losses waste.

Separation and grading: Separation and grading enable to separate the damaged and broken down seeds from the normal seeds in order to have batches uniform in size and form. They are conducted by means of sieves and separators with cylinders or discs. The grading facilitates the adjustment and use of the mechanical grain mills.

4.2.4.2 Basic infrastructures

They are the seeds processing and storage infrastructures indispensable for the implementation of a sustainable sub sector destined to guarantee a regular supply of quality seeds to the producers.

For the processing of food crop species, Senegal presently has three seeds sorting units located in Diourbel, Richard-Toll and Tambacounda. Each of these stations has a processing capacity of 9 tons/hour. There are also a few mobile seeds processing units of an average capacity of 2 to 3 tons/hour in Keur Samba Guèye, and Anambé and of 600 kg/hour in Diouloulou.

The centers of Diourbel and Richard Toll were renovated and equipped at the beginning of the 90s. They ensure the processing of the certified seeds sold in the formal channel and also, the processing of the « mixed seeds » of the Government's special programs. They are managed by the seeds private operators, members of the UNIS after a memorandum of agreement defining their conditions of technical and financial management. The agreement was signed between the Ministry of Agriculture and the UNIS for a five-year duration. An evaluation should be conducted and the final sale price of the centers determined.

4.2.5 The sub sector economy segment: marketing and distribution

Marketing is an activity essential for the success of any agricultural policy. It is essentially based on a good organization of the entire seeds sub sector and particularly on:

- A good estimate of the farm gate price and the establishment of profitable prices;
- A good control of the prices of storage and of warehouses maintenance ;
- A good control of the transportation and handling costs ;
- Raising of normal standards of the sub sector by the respect of the commitments and an establishment of relatively correct margins;

- A regular dissemination of the certified seeds ;
- etc.

In reality, several non registered producers and suppliers intervene in the sub sector. They produce or purchase seeds directly from the producers before selling them on the market. Thus, several farmers' groups and small intermediary traders are working in the sub sector without having, for all that, any legal authorization.

If important steps were made in the area of fertilizers and seeds marketing in most of the country' s producing zones where there are inputs' shops, it is not the same for the seeds. The lack of credit allocated to the food sector and to the private merchants makes heavy a system which has difficulties to be established.

One aspect which is not very enhanced consists of taking advantage of the opportunities offered by the intellectual protection.

The intellectual protection increases the value of research efforts. It forbids the production and marketing of seeds without prior approval of the variety holder. Generally, the low involvement of the private sector in activities of varieties creation and non hybrid seeds is explained by the absence of clearly defined mechanisms of the copy rights protection. Consequently, the government is brought to be the only actor involved in variety creation.

Another constraint, no less negligible, concerns the respect of the regulation of the activities of imports, exports and distribution of certified seeds. These are subject to the control of the Ministries of Agriculture and Commerce which requires first a crop protection certificate and pro forma invoices. The crop protection certificates enable to identify and prevent the spread of pests and diseases which can cause a significant economic and environmental damage. Regarding the invoices, they favor a better control of products' purchase and sale prices. However, it is worth noting at this level the lack of respect of the regulatory procedures which causes a certain number of inconveniences to the local producers. The latter see their efforts diluted over time. This situation is all the more unfortunate that most of the seeds available on the market are produced by the traditional sector.

The example of the truck farming sector which has a distribution network building on commercial entities shows that a well structured seeds sector can give interesting results. The commercial entities ensure an availability of vegetable seeds during the whole year thanks to the intermediation of the traders who can move important stocks, whenever a strong demand is recorded somewhere in the country.

According to Gorin and Sarr speaking about their company TROPICASEM (1998), the positive results on the vegetables were obtained thanks to the development of the truck farming products component, but also and especially, thanks to a good organization of the sector. This organization is built on:

- a computerized management of a central stock of processed seeds;
- a planning of the supplies;
- the creation of a network of exclusive resellers or representatives in the entire truck farming zones;
- the establishment of a permanent supply system;
- an adapted pricing structure.

Vegetables are also crops with high value added; which is not the case of the food crops. For the latter, the production and distribution of the main food crops' seeds are done from seeds' programs developed by the concerned ministerial departments during programming meetings.

These meetings are supposed to ensure a sharing of responsibilities between the main development actors according to the varieties to be cultivated, targeted locations and quantities to be produced. In reality, the seeds' programs feed a national system which operation mode does not always meet the needs of the family agriculture farmers. They are destined to cover the market requirements by the production of certified seeds conform to international standards, whereas the majority of farmers regularly use seeds of local improved varieties taken from their own harvests. Thus, despite the efforts devoted by the Government, the use of the improved seeds never reached a satisfactory level. In fact, every year, before the agricultural campaign, the farmers travel around the villages to get seeds through donations, loans or exchanges; the purchase constitutes the last recourse.

It is worth specifying to this effect that agriculture development is accompanied in Asia, Europe, and the United States by a seeds industry capable of supplying the farmers with seeds and quality plants and at the appropriate time. Thus, companies were created to conduct this activity. Certain among them developed afterwards variety creation activities. It is the case of the big seeds' firms such as PIONEER in the United States and TECHNISEM in France, which were supported by the development of a dynamic partnership between the development actors through inter-professions.

In France for example, the Groupement National Interprofessionnel des Semences (GNIS) – the National Inter-professional Group of Seeds – was created on one hand, to enable the different actors intervening in the agricultural sub sectors to harmonize their approaches, and on the other hand, to ensure the seeds' producers adapted advisory/support services. The GNIS plays an interface role between the seeds' organizations and the public sector. The UNIS was created in Senegal under this spirit.

The absence of a dynamic commercial sector seems to constitute one of the main bottlenecks of the seeds sub sector. The latter needs to be stowed to the market in order to become competitive and consequently, interesting for the entire development actors, particularly the producer, intermediary, trader and industrial actor. This is the case of the seeds sub sectors of the industrial crops for which, the value of the products as well as that of the seeds, is determined by the market.

The development of a seeds market is essentially built on:

- a market study;
- a determination of the operating accounts;
- a profitable pricing;
- an adequate distribution of the products;
- a promotion of the seeds;
- the creation of an enabling environment to private investment.

The pricing and costing of the certified seeds production

The production costs of the different levels will be discussed later from the budgets of crops of the different categories of seeds. In this chapter, the production costs of the certified seeds which represent the last step of the seeds production process, -- are analyzed.

The pricing of the certified seed R2 is done according to the:

- farm gate price of the consumption product (the farmer who multiplies seeds must be paid for the efforts devoted for the respect of the technical standards of seeds production and storage) ;
- costs of collection, processing, conservation and transportation;

- financial costs;
- expected profit.

The pricing structure of the kilogram of seeds (R2) to be disseminated by species is presented in table 11:

Tableau 11: Price of the seeds to be disseminated by species

ITEM	Rice	Maize	Millet	Sorghum	Cowpeas
Seeds farm gate price*	198	150	150	150	325
Costs of collection, processing, storage, marketing	39	75	75	75	75
Transportation costs	13	13	13	13	13
Financial costs	25	24	24	24	29
Seeds Fund	2	15	15	15	15
Profit margins	33	123	123	123	143
Sale Price	300	400	400	400	600

NB: the farm gate price of seeds is set by the seeds private operator according to the agricultural product price and the seed sale price.

Characteristics of the seeds marketing

The seed marketing has the following characteristics which concern:

- 1) three markets : the Government's agricultural program, the weekly markets and the neighboring countries ;
- 2) four types of sellers : the seeds private operators, the seeds firms, the traders and the big producers (often *marabouts*);
- 3) one client : the farm

The Government's agricultural program

The Government's agricultural program concerns the seeds of peanuts, maize, cow peas, sesame, rice, millet, sorghum, and fonio, -- and the horticultural plants. It is generally a market of products subsidized by the Government for up to 50%.

Figures 2 and 3 and table 12 present the quantities of the subsidized products and their origins (local or imported). The analysis of these figures and the table reveals that, since 2006, the Senegalese Government has been increasing each year the quantities of the subsidized seeds as well as for peanut and maize.

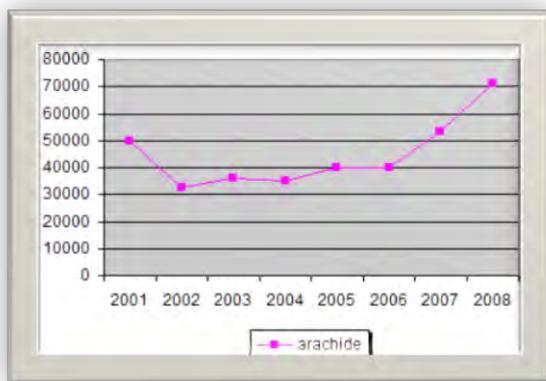


Figure 1: Evolution of the quantities of subsidized peanut seeds

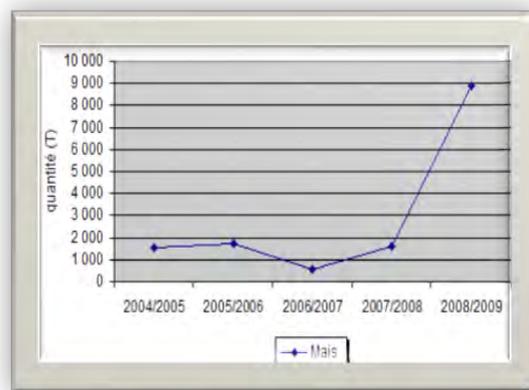


Figure 2 : Evolution of the quantities of subsidized maize seeds

Table 12: Evolution of the subsidies allocated to the seeds (2001 - 2008)

Nature	2001	2002	2003	2004	2005	2006	2007	2008	Total
Total subsidies to agricultural programs (billions CFA Francs)	9.92	0.5	11.55	20.4	13.1	21.65	29.43	31.12	137.67
Share of seeds (%)	59.7	0.0	54.1	34.1	33.6	14.8	35.3	26.9	33.0

Several actors operate on the subsidized seeds market. Among them, we can count the seeds private operators, sellers of certified seeds, and traders-sellers of ordinary or « mixed seeds ». The profit margins are interesting; which explains the intervention of a great diversity of actors (Table 13).

Table 13: Volumes of seeds subsidized under the GOANA (2008)

Crops	Quantity (T)	Sale price (CFA Franc/kg)	Government Subsidy (CFA Franc/kg)	Cost borne by the farmers (CFA Franc/kg)
Millet	3, 960	500	400	100
Sorghum	2, 123	500	400	100
Maize	6, 478	600	420	180
Rice	1 676	425	325	100
Fonio	4	500	400	100
Cowpeas	5, 643	800	650	150
Peanut	70, 000	225	125	100

Weekly Markets

The weekly markets are rural markets where the traders of ordinary seeds come to sell their products before the rainy season. The sale of the seeds, where the origin and the category are unknown, is in principle forbidden by the law in the sanctions chapter. The volumes of transactions based on the traders supply are difficult to control. It is the same for the personal reserves sold by the farmers.

Overall, the seeds distribution in Senegal faces several markets with a same type of client – the farmer. One can find in it a big diversity of seeds and varieties, informal sellers (sellers « of mixed seeds » and « skimmed seeds ») who meet in it sellers officially registered as sellers of certified seeds without being worried neither by the controllers from the agricultural departments, nor by those from the Ministry of Commerce. What is still more astonishing is that these informal sellers of grains as seeds are in some cases the big suppliers of the Government's agricultural program. Such a market favors a competition with the formal sector. It explains (perhaps?) partially the decline of the production of certified seeds of the main crops cultivated which encounters enormous difficulties to find buyers.

Finally, it is worth noting the dynamism of the activities of certified rice seeds in the Senegal River Valley. This dynamism goes beyond the local concerns to cover the seed requirements of certain neighboring countries (Mauritania, the Gambia, and Guinea-Bissau). This particularity was saluted by FAO which funded a study for a harmonization of the seeds' regulations between Mauritania and Senegal in 2001.

System of seeds supply to producers

For rain-fed crops, most Senegalese farmers get their supplies from farm seeds. These seeds, originated from personal reserves of traditional cultivars and improved varieties, are subject to a mass selection at the farm level. However, when these reserves are not sufficient to cover their requirements or in case of climate uncertainties (draught for example), the producers buy certified seeds.

Concerning irrigated rice, the part covered by the selected variety is 100 %, the rice varieties only used during the rainy season. Thus, the frequency of varieties change at the producers' level is globally low except under rice cultivation which recorded these past years the registration and adoption of about ten improved varieties. But here also, the renewal of the vegetal matter by the foundation seeds is not frequent.

4.2.6 Segment of the services and users

This segment essentially concerns the transporters, bankers, traders and seeds' resellers.

The transporters intervene in the sub sector to transport the seeds from one zone (or area) to another. The real transportation cost varies according to the volumes and the interlocutors' negotiation capacities. However, it is noted that on average, it is from 10 to CFA Francs/kg for the important volumes of 10 – 30 tons. These prices can sometimes go up to 25 – 50 CFA Francs, when the transported quantities are low or not accompanied by the owner.

Regarding the bankers, the Caisse Nationale de Crédit Agricole du Sénégal (CNCAS) – Senegal National Agricultural Credit Bank - created by the Senegalese Government to finance the agricultural sector, the annual interest rate applied on the crop credit is 7.8 % at the CNCAS. It is the same for all the crop productions. On the other hand, that of the collection and processing credit of the certified seeds is 11 %.

For few years, the intervention of the credit and savings unions beside the CNCAS was noted to finance traders and resellers. Credit is more easily accessible. Also, despite the high enough interest rates (around 2% per month), the saving and credit unions have several clients. However, they only finance the heavy investments and the long-term loans. Consequently, the investment in seeds production is done essentially under the general framework of the Government's agricultural credit.

There exist no specific measures of agricultural credit which can promote investment in the seeds sub sector. One can understand from then on the difficulties for the seeds multipliers and operators to correctly take in charge the investment and operating expenses. Very often, an important part of the production is not collected due to lack of marketing credit.

On the other hand, the number of processing centers has not evolved since twenty years due to of private investment whereas the equipment is completely depreciated. The support programs to the rice seeds value chain should then take into account this constraint, appropriate solutions should be found.

V. COST-EFFECTIVENESS ANALYSIS OF THE VALUE CHAIN

The value chain analysis will be conducted by segment (multiplier, processing, and marketing) and by production system. The importance given to the certified seed is not the same according to the production systems (irrigated and rain-fed systems).

5.1 Production systems

The rain-fed system constitutes the essential of the production systems; only 3 % of the areas are allocated the irrigated crops mainly developed in the Senegal River Basin. All production systems taken into account the mostly cereal crops are by order of importance (2008 data, Directorate of Agriculture):

- Millet/Sorghum: it covers about 1 million hectares with an average yield of 0.6 ton/hectare ;
- Rice : it occupies 150, 000 hectares with an average yield of 2.3 tons/hectare ;
- Maize: it covers 100, 000 ha with an average yield of 0.9 ton/hectare.

The cereal production reached an average of about 930, 000 tons during the ten past campaigns with very marked fluctuations according to the years and the rainfall.

Despite very important investments made, especially at the level of hydro-agricultural investments in the Senegal River Basin and the Anambé Basin, the food deficit was constantly getting worse.

In view of the five past years' average, imports of cereal products amounted to 1, 320, 427 tons of which 870, 520 tons are rice; or 66% (Information note of the External Trade Department, ANSD/MEF, 2008 edition).

The majority of the producers are small agricultural holders. On average, they occupy areas of 1.5 hectares to 3-5 hectares. They cultivate land according traditional land tenure systems and practice traditional rotation of crops. Most of them practice an association of crops (cash crops and subsistence food crops). They also possess few animals that they maintain in extensive or semi-intensive livestock.

Truck framing benefits from an environment favorable to its development in the local market as well as for export towards the sub region and the international market. Its potentials are important particularly in the Niayes, in Casamance and in the South of the Peanut Basin.

5.2 Cost-effectiveness and competitiveness in the production systems

5.2.1 Cost-effectiveness and competitiveness of the production of irrigated rice seeds

The cost-effectiveness and competitiveness of the production of irrigated rice seeds were calculated according to the approach of the « Matrice d'Analyse des Politiques (MAP) » - Policies Analysis Matrix – through models of budgets developed under Excel at the benchmark prices and the market prices.

Economic and financial ratios were estimated for the calculation of the efficiency prices and the non tradable costs.

The calculation assumptions are based on information collected from official sources (DAPS/MA, ANSD/MEF, etc.), studies on the sector, and data of the production sites collected during the exercise.

The typical farm is the one representing the production system of a seeds multiplier who produces certified seeds R1.

In irrigated zone, in the Senegal River Basin, this multiplier is a member of a union which processes his product at the Richard Toll station. In the Anambé Basin, this multiplier processes his product at the Tambacounda station.

The analysis was conducted at the user's (farmer) level which constitutes the last link of use of the certified seeds destined to the households' consumption. On one hand, it aims at appreciating the earning in value added brought generated by the use of good seeds in the farm, and on the other hand, at improving the yields and their impact on the country's food security.

Seeds multiplier segment

In view of the above budget, it emerged that the seeds multiplication activity is profitable both in the Senegal River Basin and the Anambé Basin.

In the Senegal River Basin, it offers a net financial margin per hectare in the order of 598, 420 CFA Francs, a value added to the financial prices per hectare of 732, 420 CFA Francs, and a CDR of 0.49.

In the Anambé Basin, it gives a net financial margin per hectare of 55, 150 CFA Francs, a value added to the financial prices per hectare of 118,650 FCFA, and a CDR of 0.75.

The result of the seeds multiplication activity is much more profitable in the Senegal River Basin with a value added per hectare and at financial prices seven times higher those of the Anambé basin.

The different CDRs obtained are lower than 1. This means that the production of rice seeds in the Senegal River Basin and in the Anambé Basin is done at a cost lower than that associated with the use of these same resources on the international markets.

Table 14: Financial and economic accounts of the rice seeds R1 multiplication

	Senegal River Valley		Anambé Basin			
	Financial costs (CFA Francs/ha)	Economic costs (CFA Francs/hectare)	Tradable costs (CFA Francs/hectare)	Financial costs (CFA Francs/hectare)	Economic costs (CFA Francs/hectare)	Tradable costs (CFA Francs/hectare)
Costs	1, 221, 580	1, 206 207	620, 402	919, 850	871, 791	557, 523
Revenues	1, 820, 000	1, 820 000		975, 000	975, 000	
Production costs/kilogram	218	215		307	291	
Net margin /hectare	598, 420	613, 793		55, 150	103, 209	
Net margin/kilogram	107	110		18	34	
Value Added/kilogram	131	134		40	56	
Value Added/hectare	732, 420	747, 793		118, 650	166, 709	
Production site CDR		0.49			0.75	
Source of calculations:						
(i) Operating accounts of the PSOs in the Senegal River Basin						
(ii) August 2009 SAGIC / EGP surveys						

Table 14 represents a summary of the economic and financial accounts of the seeds R1 in the irrigated production systems of the Senegal River Valley and the Anambé Basin. The value added is used as an indicator.

The value added constitutes the difference between the product value and the value of the tradable inputs' costs. It shows to what extent the system can bear the domestic factors (including a normal return on capital) while remaining competitive.

The calculation of the value added brings about well-known differences of the value added between the seeds production in the Senegal River Valley (732, 420 CFA Francs/ha) and in the Anambé Basin (118, 650 CFA Francs/hectare). Two crucial aspects seem to explain the high CDR level in the Anambé Basin:

- The low yields ;
- The high processing costs applied outside the production zone, particularly in Tambacounda.

These constraints can be removed, if efforts are devoted to that effect.

Users/ farmers segment

The user/farmer budget was developed in order to know the profit margins recorded per kilogram in rice cultivation by using the crop management sequence techniques. Table 15 shows that this margin can be 88 CFA Francs/kg in the Senegal River Valley compared to 45 CFA Francs/kg in the Anambé Basin; which represents a value added per hectare in the Senegal River Valley of 482,446 CFA Francs/ha which is seven times higher than that of the Anambé Basin which is only 69,500 CFA Francs/hectare.

Table 15: Users/farmers budget

Items	Units	Senegal River Valley	Anambé Basin
Costs	CFA Francs/hectare	469, 025	316, 500
Revenues	CFA Francs/hectare	1, 176, 471	450, 000
Net margin	CFA Francs/hectare	707, 446	133, 500
Net margin	CFA Francs/hectare	88	45
Value added/kilogram		60	23
Value added/hectare		482, 446	69, 500

Seeds marketing/distribution

Table 16 presents the operating account of a rice seeds trader in Ross Béthio. The latter earns 13, 000 CFA Francs on each ton sold. He previously invested in seeds production but finally preferred, due to the arrival of new actors in the sector, to get specialized in seeds trade and distribution. He regularly works with the CNCAS which provides to his clients « orders for delivery and payment ». These orders contain all the details regarding the products to be delivered. After delivery, the trader presents the duly signed document to the bank for payment.

Table 16: Operating account of a rice seeds trader in Ross Béthio (St Louis)

Items	Prices	Quantity	Total
Purchase of processed seeds (CFA Francs/kilogram)	275	1,000	275, 000
Transportation (CFA Francs/ton)	6,000	1	6, 000
Handling (CFA Francs/ton)	1,600	1	1, 600
Total expenses (CFA Francs)			287, 000
Sale of processed seeds (CFA Francs/kilogram)	300	1,000	300, 000
Gross margin (CFA Francs/ton)			13, 000

5.2.2 Cost-effectiveness and competitiveness in the seeds production of rain-fed crops seeds (millet, sorghum, maize, rice)

Considering the new rainy season physiognomy, the production of millet, sorghum, maize and rain-fed rice is mainly done in the Central peanut basin, in Eastern Senegal and in Casamance. The cost-effectiveness study concerns the segments of the multiplication, processing, marketing/distribution and use of the seeds by the farmers.

If the financial analysis deals with all these segments, the economic analysis on the other hand uniquely concerns the seeds multiplication and use by the farmers; the objective here is to see if there are an economic cost-effectiveness and a comparative advantage at the two segments level.

The same approach with the same assumptions than for irrigated rice is used. The difference takes places especially at the processing level which is conducted for the central peanut basin in Diourbel and for Eastern Senegal in Tambacounda.

Seeds multiplication segment

The multiplication of cereals certified seeds (millet, sorghum, maize and rice) is conducted under special programs with structures settled in the production areas (companies, agencies, GIEs, NGOs, etc.).

At the national level, ANCAR has been experimenting since 2002 a community production program of millet and sorghum certified seeds in partnership with the CLCOPs on small areas. In the case of the regions of Kaolack and Kaffrine, this program concerns 21 rural communities.

On its side, SODEFITEX produces certified seeds of rice and maize in partnership with contracting farmers to whom it gives inputs for that purpose. For rice, the company gives 40 kilograms of seeds R1 at 350 CFA Francs/kg and buys back the production at CFA Francs/kg.

Since 2006, World Vision has been implementing a seeds multiplication program in relationship with the seeds department in seven rural communities of Kaffrine. It recently obtained 1,720 kg of millet seeds and 656 kg of maize seeds. This program is conducted with four seeds' producers who each cultivate

over one hectare (three producers for millet and one for maize). The seeds are then bought back at 150 CFA Francs/kg and given at no cost to 170 « leaders » farmers. However, the farmers who do not participate in this program must buy the seeds at the price of 450 CFA Francs/kg for millet and 375 CFA Francs for maize.

Other structures are intervening in the sector. They are particularly:

- The GIE Tollu Baye which has agricultural equipments and cultivate an area of 400 hectares
- The SEDAB (private company) which contracts out with seeds multipliers and buy their productions in order to put them into the Government's agricultural program. The activities of this company concern 400 managers, 35 supervisors and 15 coordinators for a four-month period.

Tables 17 and 17a show that the seeds multiplication activity is also profitable in the areas of rain-fed crops. It benefits from an interesting comparative advantage. The CDRs are everywhere lower than 0.5 except for rain-fed rice; which explains the level of its yield.

Table 17: Economic and financial accounts of seeds' multipliers under rain-fed conditions

	Maize (Tamba)			Rice (Tamba)		
	Financial costs (CFA Francs/ha)	Economic costs (CFA Francs/ha)	Tradable costs (CFA Francs/ha)	Financial costs (CFA Francs/ha)	Economic costs (CFA Francs/ha)	Tradable costs (CFA Francs/ha)
Costs	353, 762	368, 782	72, 925	456, 000	445, 400	35, 080
Revenues	900, 000	900, 000		630, 000	630, 000	
Production costs/kg	157	164		253	247	
Net margin /ha	546, 238	531, 218		174, 000	184, 600	
Net margin/kg	243	236		97	103	
Production location CDR		0.36			0.69	

Source: SAGIC Surveys (2009)

Table 17 a: Economic and financial accounts of seeds' multipliers under rain-fed conditions

Items	Millet (Peanut Basin)			Sorghum (Peanut Basin)		
	Financial costs (CFA Francs/ha)	Economic costs (CFA Francs/ha)	Tradable costs (CFA Francs/ha)	Financial costs (CFA Francs/ha)	Economic costs (CFA Francs/ha)	Tradable costs (CFA Francs/ha)
Costs	314, 128	327, 064	76, 601	330, 582	348, 074	94, 042
Revenues	720, 000	720, 000		1. 200, 000	1, 200, 000	
Production costs/kg	262	273		165	174	
Net margin /ha	405, 872	392, 936		869, 418	851, 926	
Net margin/kg	338	327		435	426	

Source: SAGIC Surveys (2009)

Farmers/users segments

The farmers/users benefit from the Government's subsidy through its agricultural program which promotes the use of certified seeds. However, the general opinion of the interviewed farmers is that it often happens that the operators get supplies from the local market and serve them « mixed seeds ». This situation destroys any effort of certified seeds use. In addition, it discourages the real seeds operators.

It should be noted, between others, that the inaccessibility to quality seeds, higher prices and lack of information on the existence of stocks, are the main constraints noted along the users.

In a more specific manner, certain producers particularly those from the Peanut Basin declare that they do not know the storage locations of the certified seeds of millet and sorghum. This is paradoxical enough because at the same moment, The PSOs complain that they cannot sell their stocks due to lack of market. It is the same for maize and rain-fed rice for which, the farmers do not find seeds on the markets. The maize case is particular enough because certain farmers often express doubts on its quality but also on the varieties they still do not know (hybrid or composite), due to lack of reliable information.

Table 18: Economic and financial accounts in rain-fed areas for the farmers/users

Farmers/users	Units	Millet		Sorghum		Maize	Rain-fed rice	Rain-fed rice
		Central Peanut Basin	Eastern Senegal (SO)	Central Peanut Basin (BA)	Eastern Senegal (SO)	Eastern Senegal (SO)	Casamance	Central Peanut Basin (Fatick)
Costs	CFA Francs/ha	78, 465	79, 465	81, 607	98, 607	135, 114	138, 000	122, 500
Revenues	CFA Francs/ha	180, 000	180, 000	300, 000	300, 000	375, 000	300, 000	300, 000
Net margin	CFA Francs/ha	101, 535	100, 535	218, 393	201, 393	239, 886	162, 000	177, 500
Net Margin/kg	CFA Francs/kg	85	84	109	101	96	81	89
Value added/kg		60	58	93	76	78	43	52
Value added/ha		71, 535	69, 535	186, 393	152, 393	194, 886	85, 000	104, 000

Source: SAGIC Surveys (2009)

- Casamance: Ziguinchor, Kolda
- Bassin Arachidier (BA) - Peanut Basin: Central: Kaolack, Kaffrine
- Sénégal Oriental (SO) – Eastern Senegal: Kounghoul, Tambacounda

Table 18 shows that the incomes generated for the consumption production from the certified seeds are substantial enough in comparison with the value added per kilogram gotten with regard to that of the farmers using « mixed seeds ».

For rain-fed rice for example, the farmers use organic fertilizers instead of chemical fertilizers. To this effect, the organic inputs cost was calculated on the basis of the half of the use costs of the chemical fertilizers (assumption recommended by the officers of SODEFITEX seeds unit).

The farmers/users budget analysis also revealed that the incomes generated by sorghum cultivation in the central Peanut Basin (Kaolack, Kaffrine) are substantial enough. They are followed by those of maize in Tambacounda.

The domestic resource costs (DRC) obtained in the different production locations show that there exist comparative advantages in the use of certified seeds because they strongly contribute to the yields increase. The simulations made with the model indicate that the CDR is very sensitive to the yield.

Table 19: Comparison of the CDR per species

Seeds/areas	Production location CDR
Millet/ Peanut Basin	0.27
Millet/Eastern Senegal	0.28
Sorghum/Peanut Basin	0.15
Sorghum/Eastern Senegal	0.22
Maize/Eastern Senegal	0.28
Rice/Casamance	0.25
Rice/Fatick	0.20

Seeds processing segment

The operating accounts of the processing centers (Diourbel, Tamba and Richard Toll) are presented as follows:

Diourbel Processing Center

Table 20: Operating account of the Diourbel center

	Expenditures' Items	Presentation of the seeds in PP bags			
		4 kg	8 or 10 kg	16 or 20 kg	40 or 50 kg
PROCESSING BUDGET	Fumigation of raw seeds' stocks	.5	0.5	0.5	0.5
	Bagging	20	12	10	5
	Fungicide	21	21	21	21
	Labor	4	3	2,2	1.2
	Small consumables (oils, fats, painting, thinner, broom, masks, gloves...)	0.5	0.5	0.3	0.2
	Big consumables	0.3	0.3	0.3	0.4
	Electricity +Water +Telephone consumption	2.5	2.5	2.5	2.5
	Personnel costs (guard, manager, laboratory assistant, technician, secretariat)	3	3	3	3
	Miscellaneous	0.2	0.2	0.2	0.2
	Total	52	43	40	34

NB: the processing costs billed to the operators are:

- a) Processed finished seeds in small PP bags of 4, 8, 16, and 20 kg:
 - 80 CFA Francs/kilograms for a submitted weight of 1 to 100 tons
 - 60 CFA Francs/kilogram for a submitted weight of 100 tons

- b) Processed finished seeds in small PP bags of 40 or 50 Kg =
- 60 CFA Francs/kilogram for a submitted weight of 1 to 100 tons
 - 45 CFA Francs /kilogram for a submitted weight of more than 100 tons

Tambacounda processing center

SODEFITEX bears the electricity costs but, in return, it does not pay the utilization costs of the processing chain; i.e. the 35 CFA Francs/kilogram. It also bears the seeds treatment costs and the allowances given to the DRDR technical agent for the chain management.

The processing costs of the ton of seeds are as follows:

Table 21: Operating account of the Tambacounda station

Item	Price (CFA Francs)
Processing chain costs	35, 000
Grading	2, 000
Insecticide treatment	4, 600
Certification licenses	5, 000

Source: SAGIC Surveys (2009)

Remark: A sorting gap of 10% is taken into account in the economic calculation for the processing centers of Tambacounda and Diourbel.

Richard Toll Processing Center

The Richard Toll center operates 9 months out of 12. It includes two processing chains which have been in existence since the 70s. The net accounting value of these infrastructures is null if we consider that the payback periods are far exceeded. The center is often solicited by the operators and is consequently often out of order.

Table 22: Operating account of the processing chains of the Richard Toll centers

	Units	Quantity
Capacity	Ton	25
Work days/week	Day	6
Work months/year	Month	9
Work days/year	Day	216
Processed tonnage/year	Ton	5,400
Chain services	CFA Francs/ton	5,500
Salary (357,500 CFA Francs/month)	CFA Francs/ton	595.83
Spare parts (50,000 CFA Francs/month)	CFA Francs/ton	46.30
Electricity (300,000 CFA Francs/2 months)	CFA Francs/ton	250
Total revenues	CFA Francs/ton	5,500
Total cost	CFA Francs/ton	892.13
Gross margin	CFA Francs/ton	4,607.87
Annual gross margin	CFA Francs	24,882,500

Source: SAGIC surveys (2009)

Considering the operating account, the result of the activity generates important incomes which could suffice for the tool replacement or modernization. In fact, the calculations show an annual gross margin of about 25,000,000 CFA Francs which are totally put back into the UNIS. However a non negligible part of this amount is used for the renovation works due to the equipment's bad state of repair. At this level, one should deplore the absence of adequate revisions of the chain's different components. In fact, even if it is difficult to make a comparison between the three processing centers and the important processed volumes, the fact remains that the Tambacounda processing station benefits from a better treatment and experiences less breakdowns. The staff training issue assigned to this task came up regularly as a major deficiency. Consequently, any future support should take into account this component which is crucial to the rational management of this working tool.

Seeds marketing in rain-fed zones

In the rain-fed zones, the trade of seeds does not experience the same scope than in the irrigated zones. The prices are high enough compared to the farmers' income, and most of them are not well informed of the seeds availability. Table 23 provides an operating account of a trader of certified seeds of millet and sorghum in Kaolack.

The study generally reveals that the trade of seeds is very profitable for the traders. The latter establish production contracts with the farmers settled in the zones with normal rainfall, and supply them with the necessary inputs. During the harvest, they repurchase the production at very concessional prices and resell it to the Government at three or four times higher prices.

Table 23: Operating account of a cereals' seeds trader in Kaolack

Items	Unit	Amount
Transportation	CFA Francs	4, 800
Handling	Ton	700
Storage	1 month	100, 000
Treatment product	Kilogram	2, 100
Processing	Ton	1, 500
Bagging	20 kg	5, 750
Marking of the bags	Ton	50, 000
Personnel	CFA Francs/ton	11, 429
Purchase of raw seeds	CFA Francs/ton	225, 000
Total cost	CFA Francs	401, 279
Sale of certified seeds	CFA Francs/ton	540, 000
Gross margin	CFA Francs/ton	138, 721

Source: SAGIC Surveys (2009)

5.3 Analysis of the value added distribution

The value added of the seeds sub sectors is analyzed according to whether one is in rain-fed or irrigated zones through the multiplication, processing and marketing segments.

5.3.1 Rain-fed zones

Table 24 indicates the different value added by type of seeds and by segment, and reveals that the seeds multipliers generate important profits of more than 50 % (60 % for millet, 72 % for sorghum, 54 % for maize, and 56 % for rice).

Concerning the use of good seeds, it generates very important production levels. In addition, it generates significant financial earnings for the different actors of the seeds sub sectors.

The analysis through the domestic resource cost shows an economic profit for Senegal thanks to a better share of the wealth at all levels: production, processing and marketing. A comparison between the different value added in the production system and the certified seeds and without certified seeds, -- shows significant differences (Table 25).

Table24: Distribution of the value added per hectare between the different segments in rain-fed zones (CFA Francs)

	Mil		Sorghum		Maize		Rice Tambacounda	
	Peanut basin		Peanut basin		Tambacounda			
	Financial price	%	Financial price	%	Financial price	%	Financial price	%
Multipliers	630, 872	60	1, 094, 418	72	771, 238	54	474, 000	57
Processing	150, 000	14	150, 000	10	70, 000	5	70, 000	8
Traders	277, 442	26	277, 442	18	590, 400	41	295, 200	35
Total	1, 058, 314	100	1, 521, 860	100	1, 431, 638	100	839, 200	100

Table 25: Value added of the certified seeds

Farmers/ users	Production Systems	Units	Millet		Sorghum		Maize	Rain-fed rice	
			Central Peanut Basin	Tamba	Central Peanut Basin	Tamba	Tamba	Casam ance	Central Peanut Basin (Fatick)
Value added/kg	With certified seeds	CFA Francs	60	58	93	76	78	43	52
Value added/ha		CFA Francs	71, 535	69, 535	186, 393	152, 393	194, 886	85, 000	104, 000
Value added/ha	Without certified seeds	CFA Francs	-33, 465	-20, 465	21, 393	36, 393	10, 886	44, 000	-79, 000

The value added per kilogram and per hectare shows a good profitability of the crops in the concerned production zones. This profitability is particularly interesting for maize in Tambacounda.

A comparison of the value added for the farmers/users of « mixed seeds » shows on the opposite side from the certified seeds, that the profits recorded here are low. They are: 44.000 CFA Francs/hectare for rain-fed rice in Casamance, followed by sorghum in Tambacounda and the Peanut Basin, respectively with 36, 393 CFA Francs/hectare and 21, 393 CFA Francs/hectare. Maize presents a very low profitability in Eastern Senegal (10, 886 CFA Francs/hectare). Concerning millet, it is cultivated at a loss because it does not cover the domestic factors.

5.3.2 Irrigated zones

Table 26 indicates the value added by segment for irrigated rice in the Senegal River Valley and in the Anambé Basin. This reveals that the seeds' multipliers in the Senegal River Valley generate a profit of more than 80 % of the value added.

Table 26: Distribution of the value added per hectare between the different segments in irrigated zones (CFA Francs)

	Senegal River Valley		Anambé Basin	
	Financial prices (CFA Francs)	%	Financial prices (CFA Francs)	%
Multipliers	732, 420	82	118, 650	25
Processing	29,135	3	70,000	14
Traders	137,500	15	295,200	61
Total	899, 055	100	483, 850	100

On the other hand, the value added of the Richard-Toll processing station is very low although this one regularly functions given the processed tonnage per year. This seems to be explained in part by its state of advanced decay.

5.4 Markets and prospects: Perspectives for the cereals' seeds

A simulation on the food performance organized in 2008 enables to have a precise idea on the need to strengthen the production tool in order to create the conditions of a significant agricultural development.

Table 27: Food performance

- Rice demand : 840,000 tons
- Mi millet/maize/sorghum demand: 924,000 tons
- Rice availability : 243,260 tons
- Millet/maize/sorghum availability in 2008/09: 1,141,925 tons
- Price deficit (outside the donations) : 596.740 tons
- Millet/sorghum/maize surplus (outside the donations) : 217.925 tons
- Balance of the planned cereal performance: - 378,815 tons

Sources: DAPS / MA / FAO (2008)

The data of table 27 show the necessity to boost the cereals production in order to cover the consumption requirements.

In the particular case of rice, the theoretical annual requirements in paddy for human consumption (including the post-harvest and hulling losses) are around 1,218,000 tons for a total population of 12, 000, 000 inhabitants (2009 National statistics). These requirements were calculated on the basis of an annual consumption per inhabitant of 172 kilograms representing:

- 25 kilograms of wheat
- 70 kilograms of rice

- 77 kilograms of millet, maize and sorghum.

To cover these requirements, with the underlying scenario (average yield of 3.26 tons/hectare), about 373, 743 hectares of irrigated rice and rain-fed rice should be cultivated; which will be difficult to accomplish, if the lands availability and demographic pressure are taken into account. Therefore, it is important to use quality seeds as well as an adequate crop management techniques sequence in order to bring back the land requirements to levels lower than 300,000 hectares.

It should be noted that that the rice situation in the West Africa sub region became particularly interesting since the 2008 crisis. In fact, the purchase price to the producer which was 70 CFA Francs/kg is now 150 CFA Francs/kilograms. Concerning the ordinary whitish rice, it is sold at 300 – 500 CFA Francs/kilogram against 200 CFA Francs /kilogram before, and the perfumed rice at 800 CFA Francs/kilogram against 600 CFA Francs/kilogram (data collected at the level of Richard Toll rice mills).

The external market also seems very promising. According to OSIRIZ (monthly report of the rice world market, June 2009), the world trade in rice, after a decline of 5% in 2008, could increase to reach about 31,000,000 tons in 2009. Given the data of tables 28 and 29, one easily understands that there is still much to do in order to meet the national demand first, and to invest in export afterwards.

5.4.1 Weight of the imports on the Senegalese economy

Evaluated in 2007 at 187 billion CFA Francs, the imports of cereal products increased by 39% in 2008, and reached 260 billion CFA Francs. Their share in the country's total imports, in value, went from 9% in 2007 to 10 % in 2008. The cereal products imported in 2007 were essentially composed of rice (175 billion CFA Francs), wheat (61 billion CFA Francs) and maize (12 billion CFA Francs). In 2008, the imported quantities of rice reached 864 thousand tons compared to 1,088 thousand tons in 2007 (Table 28).

The national productions certainly improved these past years but they remained insufficient given production levels, and significantly decreased the imports of cereals (table 29).

Table 28: Imports of cereals (volumes and costs)

	2007		2008	
	Quantities (in thousand tons)	Costs (in billion CFA Francs)	Quantities(in thousand tons)	Costs (in billion CFA Francs)
Rice	1, 088	175	864	235
Maize	98	12	106	17
Millet and Sorghum	1.20	0.10	33	7.50
Total cereals	1, 187	187	1, 003	260
Total Senegal	6, 416	2, 124	5, 619	2, 534
Rice/total cereals	92%	94%	86%	91%
Rice/total Senegal	17%	8%	15%	9%

Table 29: Results of the 2008/2009 agricultural campaign

Millet			Sorghum			Maize			Rice		
Area	Yield	Production									
(ha)	(kg/ha)	(T)									
883,619	767	678,171	254,937	995	253,771	225,161	1,828	411,499	125,442	3,259	408,840

Source: MA/ 2009 DSRP II sector review report

5.4.2 Perspectives of the seeds' markets (case of rice)

The example of rice was chosen because it constitutes a crop which is subject to a strong seeds demand in irrigated zones. Its production can barely cover the requirements for the sowing of some 84,000 hectares; which is presently very insufficient (Table 30).

The national production of certified seeds of rice is essentially conducted by seeds private operators of the UNIS – North Zone. It is destined to the irrigated systems of the Senegal River Valley and the Anambé Basin of which it covers on average 48 and 60 % of the seed requirements, respectively. This means that the seeds sub sector should develop more if one wants to efficiently face the numerous seed demands of the Government programs (PNAR and GOANA) but also, the neighboring countries.

There are real market perspectives for quality seeds and the farmers seem to be often disposed to invest in them, if the prices are relatively correct. In fact, they are conscious of the advantages in yield that they can draw from the use of quality seeds. To this end, the idea to organize each year seeds' fairs or second-hand seed sales was positively appreciated. The use of community radios was recommended to be used as efficient information dissemination on the availability of quality seeds.

Table 30: Forecasts of the PNAR Project (2008 – 2012)

Year	Irrigated							Rain-fed		Total (irrigated + rain-fed)	
	Senegal River Valley			Anambé Basin		Total irrigated		Area (Ha)	Production (Tons)	Area (Ha)	Production (Tons)
	Area (Ha)	Yield (Tons/Ha)	Production (Tons)	Area (Ha)	Production (Tons)	Area (Ha)	Production (Tons)				
2008	55,000	6.2	341,000	7,500	34,000	62,500	375,000	80,000	160,000	142,500	535,000
2010	105,720	6.2	655,454	9,500	35,956	115,220	691,320	90,000	225,000	205,220	916,320
2012	175,780	6.2	1,088,596	20,500	87,884	196,080	1,175,480	131,000	327,500	327,080	1,503,980

In relation the PNAR data, the needs in seeds are as follows:

Table 31: Seeds requirements of the PNAR Project (2008 – 2012)

Year	2008	2010	2012
<i>Irrigated rice cultivation</i>			
Senegal River Valley (hectare)	55,000	105,720	175,580
Anambé (ha)	7,500	9,500	20,500
Total	62,500	115,220	196,080

Seed R2 requirements (tons)	5,280	10,149	16,856
Seed R1 requirements (tons)	264	507	843
Seed G4 requirements (tons)	13	25	42
Seed G3 requirements (tons)	0.4	0.8	1.4
Rain-fed rice			
Rain-fed rice (ha)	80,000	90,000	131,000
Seed R2 requirements (tons)	4,800	5,400	7,860
Seed R1 requirements (tons)	240	270	393
Seed G4 requirements (tons)	12	14	20
Seed G3 requirements (tons)	0.4	0.5	0.7
Forecasts of the seed R2 requirements of irrigated rice (80% of requirements)	4,224	8,119	13,485
Forecasts of the seed R2 requirements of rain-fed rice (30% of requirements)	960	1,080	1,572
Total seed R2 requirements	5,184	9,199	15,057
Total Seed R1 requirements	259	460	753
Total Seed G4 requirements	13	23	38
Total Seed G3 requirements	0.4	0.8	1.3

VI. STRATEGIC OPTIONS

In relation to the above mentioned problems, three strategic options were derived in order to render the value chain dynamic and capable of meeting the requirements in quality seeds. These three options are:

- A strengthening of the Government's role in the perspective of a total liberalization of the sub sector
- An empowerment of the seeds private operators
- A professionalization of the farmers' organizations

These options require a global revision of the seeds strategy. Before, more particularly during the first years of independence, the essential of the seeds policy was defined, programmed and controlled by the Direction de la Production et du Contrôle des Semences (DPCS) – Directorate of the Seeds Production and Control. Presently, and especially since the advent of the Programme des Services Agricoles et des Organismes des Producteurs (PSAOP) – Program of the Agricultural Services and Producer Organizers – which took place in 2000, -- the seeds sector is confronted with a visibility problem in its production objectives as well as at the level of implementation of the different seed programs.

It is worth noting that in order to ensure a good operation of the strategic options, a certain number of pre-requisites are required particularly at the level of seed activities coordination, in a general manner.

6.1 National Coordination of the seed activities

Since 1972, the coordination and monitoring of the seeds sub sector have been always ensured by a technical team through successively the Seeds Project, the Seeds Department, the Directorate of the Seeds Production and Control, the Autonomous Seeds Project and the Program of Support to the Private Seeds Operators. Actually, this technical coordination longer exists; which does not enable to have a certain visibility on the sub sector requirements and its real constraints. The takeover expected from the producers' organizations in particular, the seeds' associations (UNIS and later UNAOPS), -- did not materialize.

In the opinion of the sub sector actors, the coordination and supervision of any seeds program will need a restructuring of the entire seeds sub sector through the creation of new dialogue entities of seeds' programs implementation such as: (i) the Unité de Coordination des Programmes Semenciers (Coordination Unit of the Seeds' Programs; (ii) the Conseil National des Semences (CNS) – National Council of Seeds, and (iii) the Comité Technique Semencier (CTS) – Seeds Technical Committee.

Coordination Unit of the Seeds' Programs

The unit's mission will be the:

- development of a national seeds plan;
- coordination of the programs of production and distribution of the seeds of the different concerned structures ;
- programming and organization of workshops of capacity building of the different actors;
- facilitation of the Conseil National des Semences (CNS) - National Seeds Council;
- facilitation of an Observatory of the seeds sub sector;
- organization of annual meetings on seeds;
- development of sector and annual reports.

The coordination body will maintain close collaboration relationships with all the seeds' organizations at the national level. For efficiency's sake, it should be hosted within the cabinet of the Minister of Agriculture.

National Seeds Council (CNS)

Considering the seeds sector complexity, the economic stakes it creates, by its strategic role in agriculture development on the one hand, and by the diversity of the decision-making bodies on the other hand, -- the creation of a National Seeds Council (CNS) is greatly recommended. The Council's objectives will be to study and regularly propose to the Government and the different partners the great orientation lines of the national seeds policy.

The CNS function will be to: (i) approve the national seeds plan; (ii) determine the institutional framework of its implementation; (iii) provide financial support to the different actors for the renovation of storage infrastructures, the acquisition of new equipments, the operation and coordination; and (iv) ensure the training.

The CNS will be composed of representatives from the following:

- the Ministry of Agriculture
- the Ministry of Economy and Finance
- the private sector particularly the SPOs and the farmers' organizations.

Their representation should be strong in order to weigh on the decision-making. Furthermore, the President should be chosen among them in order to impose a dynamics of change, the representative of the Ministry of Agriculture ensuring the committee's secretariat for archiving issues.

The CNS meets twice per year to cast light on the big orientations of the future seeds program.

Technical Seeds Committee (CTS)

The CTS includes the representatives from the different concerned structures for the seeds program implementation (research, the seeds' producers, the seeds control department, the extension services, the Directorate of Agriculture, and the private sector).

The CTS is a dialogue platform on the technical aspects of the seeds program (choice of varieties to be multiplied, approval of the varieties and establishment of decentralized production seeds). It is presided over by a representative from the private sector, and meets once twice a year.

6.2 Support to agricultural research

The development actors are convinced that whatever the seed model used, one should have an efficient component of foundation seeds production. For the moment, only ISRA has the necessary infrastructures through its research stations to conduct this work. In other respect, the private sector is not yet interested in directly working on the cereals which are crops with low value added if they do not benefit from Government subsidies.

In order to better conduct this mission, ISRA should invest in the following areas:

- establishment of a Unité de Ressources Phytogénétiques (URPG) - Plant Breeding Resources Unit ;
- recruitment of plant breeding specialists ;
- recruitment of breeders;
- recruitment of specialists in seed technology ;
- short-term training of researchers and technicians involved in the seed chain ;
- organization of scientific study tours for the UPSE technicians and researchers in seeds technology laboratories and in international centers of agricultural research ;
- guidance of students in thesis year ;
- guidance of interns from national and international structures working on seeds technology.

6.2.1 Establishment of a Plant Breeding Resources Unit (URPG)

Senegal does not constitute a primary differentiation zone for most of the cultivated species. However, its geographic situation (transition point between America and Asia) and its historical role (during wars, slavery and colonialism) made it an introduction center of several species which find in it a certain similarity with the ecological conditions of their area of origin.

These species, which become scarce every day, constitute reservoirs of genes which give them the resistance to the main biotic (diseases, insects) and abiotic (adaptation to draught, cold...) stresses. They hold the key to food security and sustainable development which need to be preserved.

Several species of traditional local species of cowpeas (*Vigna unguiculata*), of rice (*Oryza glaberrina*, *Oryza barthii*, *Oryza longistaminata*, *Oryza sativa*...), Voandzou (*Voandzeia subterranea*), fonio (*Digitaria exilis*), millet (*Pennisetum americanum*) and sorghum (*Sorghum bicolor*), -- are in danger of extinction due to the draught and to intensive farming of the improved varieties. They need to be preserved through a good combination of *in-situ* and *ex-situ* conservation methods.

Presently, in the absence of a Plant Breeding Resources Unit, the essential of the plant equipment used in Senegal is preserved by the breeders who regenerate it periodically in order to limit the risks of loss.

Spontaneous and sub spontaneous species continue to be kept by the farmers despite the presence of more productive improved varieties. The reasons to that reside in their multiple uses (for food and

medicine), their adaptability to the environment conditions and their hardiness. On the other hand, one should note in the farmers' behaviors a certain suspicion in relation to the technological innovations especially because of their sensitivity to the diseases and other stresses as well as the high costs of their use. In fact, they often need to use selected seeds, fertilizers and pesticides, and this tends to create a dependence on a system they not master.

The plant breeding resources are used by the breeders either immediately (after evaluation), or in the medium or long or medium term in the program of creation of new genetic variability. As a practical application of a good use of the plant breeding resources, one could cite the creation of the first rice varieties Nerica of which one of the two parents comes from the old local varieties of Casamance. They are the CG 14 or Casamance *Glaberrima* 14.

However, it is worth recognizing that the objectives of the plant breeding programs are different from those of the breeders.

The programs' objectives are the characterization, evaluation, documentation and distribution of the genetic material. This explains why the URPGs emphasize the long duration conservation of the traditional varieties, the end of selection lines, and any scarce vegetal material or in danger of extinction.

The breeders are the main users of the plant breeding resources. They often call on banks of genes (where the material prospected or introduced is stored) to put in place activities destined to meet development necessities set by the Government. Consequently, they only generally keep the material destined to an immediate use or in the short run (crossing materials, stumps).

The activities of foundation seeds production are generally conducted by the UPSE agronomists, and the breeders. Here, the lack of specialists in seed technology poses strategic orientation problems because the latter, contrary to the breeders, are only interested in priority in the approved varieties or in varieties being disseminated.

6.2.3 Recruitment of a qualified personnel

Taking into account the specificities of the works on the vegetal material, ISRA should rapidly proceed with the recruitment of the following specialists:

Experts in plant breeding resources

Two to three experts assisted by research assistants (4 to 6 senior technicians) are necessary. They will be responsible for conducting four well distinct activities, which are the:

- management (curator)
- conservation
- laboratory and field experiments (characterization, evaluation, drying, multiplication/seeds regeneration)
- computerized management of the vegetal material

Breeders

ISRA needs to have at the minimum a full-time breeder per crop. A minimum of two additional breeders will also be necessary. This would enable the breeder in charge of rice, millet and sorghum to refocus its activities on his/her basic specialty.

Experts in seed technology

The breeders support is certainly useful but it cannot in any way substitute for the seed specialists' work. Also, the recruitment of two seed technologists who would work full-time at the UPSE, and four agronomists (at a rate of one agronomist per seed farm) is more than necessary to ensure an adequate production of foundation seeds for the different major crops. In addition, the UPSE should be involved in the basic training of the development actors.

If ISRA is having difficulties to find these specialists, it can call on young graduates from the Ecole Supérieure d'Agronomie (ESA) – Advanced School of Agriculture - of Thiès who could benefit from short-term trainings in order to be operational. The employment of interns and the recourse to visiting researchers from other research institutions could also help ISRA overcome this critical period.

The support of international research institutions (Biodiversité, AfricaRice – ex-WARDA, IITA, ICRISAT, CIRAD) and specialized laboratories (ISTA, DISEM) could be of a great contribution. Sustainable solutions should be found. On this subject, negotiations should be conducted between ISRA, ESA and UCAD in order to develop appropriate training modules. Africa Rice and MSU (Michigan State University) are already working on seed technology pedagogical aids. These two institutions could provide support at this level.

The training option through internships should be privileged in order to have, in a relatively short period, experts in seeds and in plant breeding resources.

6.2.4 Strengthening of ISRA's basic infrastructures

The renovation of the seed farms and the installation or strengthening of the conservation structures in support to the selection programs and to the UPSE, are parts of the priorities which can improve ISRA's performance.

The seed farms got seriously degraded throughout the years. Regarding the germ plasma conservation infrastructures, they are not that functional. They are experiencing problems of moisture control (drying and dried storage) and of equipments' maintenance. The equipments of cold rooms, freezers and drying and storage, are mostly obsolete.

In parallel to this capacity building, the strategy which consists of limiting ISRA uniquely to the production of foundation seeds and the other partners to the registered and commercial seeds –should be reviewed. It seems important to authorize ISRA to produce foundation and registered seeds on its stations; this would enable to depreciate in part its operating expenses. The evaluation of the peanut germ plasma project (GGP / ICRISAT / CFC / FAO) in 2003 revealed that the production costs of foundation seeds G3 of peanut were high. They were 1,365 CFA Francs/kilogram (excluding the costs of structures and the staff salaries). The mission then estimated that the total cost price of the foundation seeds would be 2,500 CFA Francs/kg, if all the costs were included. Now, ISRA sells the foundation seeds at 1,000 CFA Francs/kg. This means that the difference is borne by the subsidy allocated by the Government.

This situation could be slightly improved through:

- 1) An acknowledged increase of the yields per hectare (Table 32)
- 2) An increase of the quantities of seeds to be marketed. These are for the foundation seeds from a few kilograms (millet, sorghum) to 2 - 5 tons (rice, maize).

For the first point, this goes through an intensification of the production. For the second one, the foundation seeds production would open very interesting perspectives. In fact, the more the production is higher, the cheaper it will cost. For the moment, the foundation seeds production still remains a non profitable sector and the required quantities are small enough to be of interest to the private sector

(Tables 32 and 33). The objective of appropriate revenues generation assigned to the UPSE to bear ISRA costs, -- is not yet feasible.

Table 32: Cost price of the foundation seeds G3 without structure costs and staff salaries

Crops	Yield (Ton / hectare)	CFA Francs/ kilogram
Sorghum	1.0	495
Millet	1.2	1,043
Maize	2.0	630
Irrigated rice	4.0	1,397
Lowland rice	2.5	800

Table 33: Evolution of the productions of foundation seeds G3 of maize, millet and sorghum (2006 to 2008)

Crops	2006	2007	2008
Maize	23.4	7.3	2.4
Millet	6.7	5.2	3.4
Sorghum	2.3	7.0	5.1

6.3 Strategic options and operation mode

6.3.1 Option 1: Strengthening the Government's role

This option seems interesting insofar as the privatization policy of the seeds sector did not give the expected results. The takeover expected from the UNIS could not be completely conducted. Thus, The Government is brought to directly intervene in the operation of the sub sector through its dismemberments (DA/DISEM, DRDR, SDDR) in order to avoid being accountable for an agricultural campaign without improved seeds.

The Government thus, promoted through its agricultural campaign, the introduction through private structures, of seeds of maize, millet, sorghum and rice.

This strategy nevertheless showed its limits because it is based on the promotion of agri-business without promoting domestic production. Quality seeds of mediocre quality were often bought. In other respects, the approach used much disrupted the programs initiated by the development partners. Consequently, this strategic option is not viable. It remains however interesting because it enables to rebuild the fundamentals of a profitable seeds sector, if the means are used to ensure the functions of:

- Development and promotion of the seeds sub sector
- on-going training
- seeds control and certification
- sensitization and information on the seeds' programs
- intermediation for the access to agricultural credit

Strategic option I is more or less similar to, but not totally, a return of the DPCS with however a real opening to the private sector. In fact, it is used to recapitalize the seeds sector through an important investment of the Government in the basic infrastructures particularly the processing stations and the laboratories of seeds and plant control. The situation experienced by the African countries in 2008 led to well reflect on the Government's strategic role, which after all, is the main guarantor in case of food crisis.

The private sector should here benefit from certain facilities to:

- progressively take in charge the management of certain seed farms and processing centers ;
- ensure the storage and distribution of seeds through the seed warehouses and promote the creation of agricultural inputs' shops;
- promote the advent of rural seed farms.

For this purpose, the DISEM should recruit qualified personnel to conduct the routine laboratory works, and provide a regular support to the registered technicians. The quality control is described below.

If it was adopted, Option I should not exceed a five-year period.

Quality control

Presently, the control and supervision are under the DA/DISEM responsibility at the national level which relies on the work conducted by the DRDRs at the regions level. This mechanism is supported in the Senegal River Basin by the technicians registered for the crops monitoring and control. These technicians are registered by the Service Officiel de Contrôle (SOC) - Official Control Department. Their scope of intervention is strictly limited to the field under the SOC.

The SOC mission is to:

- Supervise the implementation of the national seeds policy regarding the entire cultivated vegetal species;
- Proceed with the control of the production, collection, processing, conservation, and marketing of all the seeds and plants produced in Senegal ;
- Proceed with the certification of the locally produced seeds;
- Proceed with the control and approval of all the imported seeds and plants;
- Ensure the coordination and monitoring of the activities of the seeds supply policy;
- Coordinate the implementation of the harmonized seed regulation and look after its application;
- Participate in the implementation of several local experiments for the approval of the imported seeds destined to production and proposed to the registration in the directory of the species and varieties of plants cultivated in Senegal;
- Define the attributions that the inter-professional organizations could exert on behalf of the Government in the area of quality control all along the production chain and certification of the seeds.

The SOC is placed under the authority of the Directorate of Agriculture. It possesses the following means:

At the national level

- Agents of supervision and coordination of the national seeds production program;
- A laboratory of contradictory analyses of the seeds to confirm or invalidate, and validate the regional laboratories' results;
- Material and financial means to undertake missions of seeds control and certification.

At the regional level

- Agents of supervision, regional coordination and control and certification of multi local programs placed under the supervision of the Direction Régionale du Développement Rural (Regional Directorate of Rural Development) ;
- Nine regional laboratories of seeds' analyses.

6.3.2 Strategic option II: Private seeds operators organized around processing centers and a structured market

It consists of organizing the entire seeds mechanism through the processing stations. For this purpose, the processing centers polarize the seeds activities in their intervention zones.

The objective of this option is to help:

- 1) Structure the seeds sector ;
- 2) Have reliable information on the stocks and their quality ;
- 3) Establish a marketing mechanism of certified seeds adapted to the demand and close to the users.

The production of foundation and certified seeds should be accomplished on the basis of the activities' programming according to the demands expressed among the management committees of the processing centers.

The processing centers should have community warehouses which will be used to store the seeds while awaiting their marketing on the eve of the agricultural campaign.

After the opening of new perimeters in Dagana, Matam and Anambé under the PNAR and GOANA programs, it will be necessary to establish processing centers in these locations in order to reduce the transaction costs by bringing the seeds closer to the utilization areas.

Regarding the rain-fed zones of the Center and South, they could benefit from mobile processing units hosted within dynamic farmers' cooperatives or associations. For this purpose, the interested structures should show their good management and financial capacities.

The processing centers of Tambacounda and Diourbel should be renovated, and the Richard Toll should be replaced.

Considering the important investment required by this strategic option, it should be reserved in priority to the irrigated zones and to zones with relatively sufficient rainfall. The departments of Kaffrine, Nioro, Foundiougne and the rain-fed zones of Upper and Lower Casamance present interesting perspectives for this option.

Picture 3 : Mobile processing chain

Here the production must be intensified. The production will be conducted in an environment characterized on one hand by the presence of a system of agricultural inputs supply (foundation seeds, fertilizers, and pesticides) and on the other hand, by storage infrastructures, laboratories of analyses, and a promising market capable of ensuring the system's sustainability. The promotion of the improved and traditional varieties will also be an important asset.

In the Senegal River Valley for example, there are farmers' organizations which proved their efficiency and which could apply to manage the Richard Toll processing station. They are the hydraulic unions of Boundoum, Débi – Tiguette and the seeds' organizations (GIE Fall & Frères, Adama Diagne, Coumba Nor Thiam, UJACK of Podor and the Etablissements Natangué). These organizations should, with institutional support from the Government and development partners, evolve first towards enterprises and later, seeds' companies.

The predominance of a multitude of informal structures does not favor the development of a viable seeds sector. The example of the Société de Représentation et de l'Industrie Agricole (SRIA) - Company of Representation and Agricultural Industry -, a private company based in Rosso Mauritania, could serve as example for the accomplishment of Option II. The SRIA took in charge the production, processing, marketing and distribution of the certified seeds. For this purpose, it established a very dynamic partnership with research institutions, the seeds department, and the producers. It got also involved in the diversification of its activities in the areas of processing, services provision (plowing) and the sale of agricultural inputs and equipments (fertilizers, pesticides, rototillers, and rice mills – several small and mini rice mills were sold and installed by them).

6.3.3 Strategic option III: Professionalization of the farmers' organizations through the community scheme

This option was conducted under the Community-Based Seed System which was designed in 1997 by ISRA. This system was afterwards developed from 1998 by WARDA with the support of the World Bank programs of accelerated transfers of technologies to Guinea and Ivory Coast, and of multinational programs funded by IFAD, ADB, JICA, UNDP, and WFP.

The option is more destined to find local solutions to the conventional system limits which are having difficulties to meet the traditional agriculture needs. The latter is characterized by a multitude of small plots, the association of crops, the absence of isolation, the use of dormant varieties, etc. In these conditions, the government departments are having difficulties to work in this sector which nevertheless covers more than 90% of the market requirements.

These limits brought FAO to propose in 1993 the declared the system of declared quality, to the developing countries. Other models were also developed (see above). However, the CBSS seems to be better adapted to local realities because it brings the entire seeds issue to the village community level and from there, helps build a national seeds system essentially based on the:

- Improvement of endogenous techniques of seeds production and conservation;
- drop of the production costs of the quality seeds;
- Strengthening of the traditional networks of seeds dissemination with the establishment of a Cyber-seeds network facilitated by the farmers' organizations;
- Creation of rural seeds' enterprises ;
- Decentralization of the quality control with the creation of an entity of Techniciens Agrées (TA) - Registered technicians, and of Paysans Agents de Qualité (PAQ) – Quality Agents Farmers;
- Creation of internal laboratories at the rural enterprises level;
- Biodiversity preservation, through taking into account local varieties in the seeds' mechanisms. This activity is very important because it will enable research institutions to provide better targeted responses to the local populations needs in the fight for food security.

The CBSS originality resides in the fact that it increases the value of the farmer seeds which, in fact, are not taken into account in the conventional system despite their importance in the traditional and rain-fed production systems. For this purpose, the new concepts of « acceptable quality seed» and «controlled seed» were created on one hand, to help improve the quality of the farmer seeds, and on the other hand, give them a scientific, technical and economic content, as well as a regulatory evolution framework.

Although initially developed for the traditional systems, the CBSS can be of a great efficiency for the intensive irrigation systems. In these environments, the emphasis will be placed on: (i) the capacity building of the different actors (agronomists, field technicians, producers, controllers, etc) ; (ii) the capacity building of the farmers' organizations (management capacities, simplified accounting, stock management) ; (iii) the promotion of rural enterprises, and (iv) the decentralized management of information (bringing up information on the stocks – volumes, quality and price, fields' dimensions, products traceability, etc). These aspects, which are part of the main mechanisms of the system's operation, were often neglected by the technicians during the CBSS implementation.

Brief description of the CBSS

The CBSS is well known in Senegal. However, its use was biased by the technicians who intervene upstream as well as downstream the system without for all that, letting the farmers' organizations manage the system.

The CBSS is composed of two complementary systems: the centralized system (conventional) and the decentralized system (*traditional*).

The *centralized system* is managed by the public institutions. It focuses on the maintenance of the stumps, the production and certification of the foundation seeds, the seeds management and regulation, the seeds program, and the organization and facilitation of the seeds sector.

The *decentralized system* is managed by the farmers' organizations which are its main pillars.

In contrast with the centralized system where the farmers' role is limited to the production of seeds of 1st and 2nd reproduction, the CBSS favors the farmers' involvement in the production of foundation seeds and the seeds quality control. The certification of foundation seeds, generally not practiced, and of registered seeds, is here a compulsory operation to attest the quality of the seeds before they enter into a totally decentralized system.

Quality control

The necessity to render the sub sector more operational requires that the Government goes further in the transfer of competences towards the decentralized structures particularly the producers' associations (groups, unions, inter-professions). For this purpose, quality control should be more decentralized. It will be conducted at the perimeters level by the registered technicians. On the contrary, the involvement of the TAs and PAQ is desired.

The TAs and PAQs' mission is to promote quality control of the seeds' quality of the farmers' organizations and cooperatives. The TA and PAQ functions represent a higher step of the community system which works from the stowing of the traditional agriculture to the market system.

T traditional agriculture is characterized by a multitude of small plots, the association of crops, the absence of isolation, etc. In these conditions, the public departments have many difficulties to inventory information on the seeds, the varieties used (traditional, improved), the fields' dimensions, the products' quality, etc.

With the support of the TAs and PAQs, the farmers' organizations and cooperatives should be able to create value added through the production and use of quality seeds. In addition, with the traceability, they could do a better promotion of their structures and thus, develop customer's loyalty.

The TAs and PQAs are working for a rapid evolution of the farmers' organizations into rural enterprises and the advent of internal control laboratories. They help put in place a simple mechanism of collection, information processing and dissemination. This evolution will constitute an additional step in the professionalization of the farmers' organizations which could become real development structures capable of generating jobs in rural areas, and substantially contribute to Senegal's agricultural development.

Professionalization

The CBSS is a transitory option. It is destined to pave the way for a functional conventional seeds system. It promotes the sub sector professionalization through building technical capacities of the producers' organizations and others actors.

The advent of rural seeds enterprises, private laboratories of quality control, inputs' shops and the running of processing units in line with the produced quantities, are part of the CBSS strategic options which should promote the development of the marketing of the improved as well as the traditional varieties.

Partnerships could be developed with the WASA (West African Seeds Alliance Ouest) and AGRA (Alliance for Green Revolution in Africa). IFAD is particularly interested in the financing of income generating activities in rural areas. In addition, the information management by the users opens interesting perspectives in the area of traceability with the involvement of the development agents and the seeds department. The use by the PAQs and other mass media entities constitutes novelty destined to promote the farmers' organizations and the trade of quality seeds and other agricultural products.

VII. TAKEOVER PERSPECTIVES OF THE SEEDS SECTOR BY THE PRIVATE SECTOR

Although they are crops with low value added and easy to reproduce, the cereals represent, by their importance for the Senegalese agricultural economy, a promising niche from which the seeds sector could generate wealth. Therefore, it is greatly recommended to the private sector to invest in it.

For this purpose it is interesting to target the following three niches:

- processing
- quality control
- information management

7.1 Processing

7.1.1 Annual profit margin per crop

A forecast under the PNAR which objectives are to reach food security in 2012 shows the following seed requirements:

Table 34: Quality seed requirements

Species	Areas planned for 2012 (ha)	Productions (Tons)	Needs in seeds (Tons)	Coverage rate (% certified)	Quantity to be covered (Tons)
Rice	327, 080	1, 500, 000	26, 166	80	20, 933
Maize	200, 000	600, 000	4, 000	60	2, 400
Millet/Sorghum	1, 666, 000	1, 000, 000	8, 330	30	2, 499

Brought o the crops' budgets which would represent for the private sector a minimal annual profit margin per crop of:

- Rice = 88 CFA Francs/kg x 20,933 = 1,842,104 FCFA
- Maize = 96 CFA Francs/kg x 2,400 = 230,400 CFA Francs
- Millet / Sorghum = 85 CFA Francs/kg x 2,499 = 212,415 CFA Francs

7.1.2 Investment requirements

The investment requirements essentially focus on the : (i) support to the foundation seeds production ; (ii) organization of the production around processing stations and (iii) the organization of the production at the village community level.

7.1.2.1 Support to the foundation seeds production

The objective of this support is to enable ISRA to have optimal conditions to ensure the production of foundation seeds in the seed farms. It will concern:

Plant breeding resources

- The construction of a plant breeding resources laboratory equipped with :
 - **One drying and one pre-processing room**
 - **One room for handling the seeds**
 - **One culture room (for the germination tests)**
- the establishment of a basic collection to secure the vegetal matter (construction of a cold room for long duration conservation)
- the establishment of active collections to meet the needs of the breeders and other users
- the securing of the regeneration/ multiplication plots of the ex-situ collections The laboratory will be encouraged to use the integrated and complementary methods of conservation of the species such as the conservation in the form of tissue culture, cellular tissues or ADN molecules. It will work with the tissue culture laboratories of ISRA, UCAD and CERAAS (Centre d'Etude Régional pour the Amélioration de l'Adaptation à la Sécheresse) - Regional Center for the Improvement and Adaptation to the Draught.

Table 35: The laboratory equipments

Logistics and equipments	Quantity
• Field trip vehicles	1
• Field vehicle (4 x 4)	1
• Collection equipment	1
• Freezers	5
• Hydro thermograph	1
• Moisture measurement equipment (automatic reading)	1
• Emergency generator	1
• Bag sealing	1
• Binocular magnifying glass	1
• Machine to seal boxes	1
• Precision scale of 0,1 mg	1
• Precision scale of 0,01 g	1
• Laboratory ventilated sterilizer	1
• Incubator/Refrigerator	1
• Seeds grinder	1
• Laboratory threshing machine	1
• Seeds Counter	1
• Computer + Accessories	1
• Modem for Fax and Email	-
• Drying room equipment	4
• Dryer	2
• Dehumidifiers	-
• Miscellaneous (small aluminum bags, containers, silica gel, sieve...)	-

Selection

- The construction of four rooms destined to the active and basic collections

Seeds production unit

The UPSE will need production equipment particularly:

- 4 tractors with accessories (1 tractor per seed farm)
- 1 mini-processing chain

- 1 grader
- Precision scales and weighing scales
- Analysis and seeds treatment processing equipment
- etc.

7.1.2.2 Organization of the production around processing centers (Option II)

The investment needs for option II essentially concern the establishment of processing stations and a revolving fund in the form of bank loans.

A proposal of the locations where the processing stations should be installed was made by taking into account the spatial distribution of the production zones and their importance in the production systems. In relation to these criteria, the following industrial mechanism is proposed to bring the processing centers closer to the producers:

Locations	Type	Capacity (Tons/day)	Approximate price including the shelter (CFA Francs)
Richard Toll	New station	30	170,000,000
Tambacounda	Renovation	30	10,000,000
Diourbel	Renovation	30	10,000,000
Matam	New station	25	50,000,000
Fatick	Mobile unit	12	25,000,000
Kolda	Mobile unit	12	25,000,000
Vélingara	Mobile unit	12	25,000,000
Bignona	Mobile unit	12	25,000,000
Oussouye	Mobile unit	12	25,000,000

To make easier the installation of the private seeds operators, a line of credit should be established and hosted in a local bank for this purpose.

7.1.2.3 Organization of the production for the village communities (Option III)

The community option was proposed for the professionalization of the farmers' entities. It aims at restructuring the sub sector from the grassroots where rural enterprises will be created. Some among them could evolve in the future to become companies. The rural enterprises will be built on an operational mechanism including:

- Processing centers and mobile units ;
- Internal control laboratories;
- Inputs' shops (seeds, fertilizers, and pesticides) and eventually small agricultural equipments ;
- Storage warehouses of 200 tons of capacity for the conservation of seeds processed by the processing centers and mobile units. In principle, five warehouses would suffice per unit ;

- Cereals warehouses of an average capacity of 100 tons for the conservation of the seeds directly bought back from the producers.

The conditions mentioned above are of nature to create an environment favorable to the professionalization of the farmers' organizations as well as the establishment of a regulatory framework. In fact, a revision of the technical regulations will be necessary at this level.

7.1.2.4 Accompanying measures

For options 2 and 3 to be successful, accompanying measures should be implemented. These measures should be programmed over time according to the producers' organization level. They are particularly the:

- Availability of foundation seeds;
- Building of the producers' technical and organizational capacities;
- Support to the professionalization for a rapid evolution of the farmers' organizations towards dynamic and well structured organizations;
- Capacity building of the TAs and PAQs ;
- Training of technicians in charge of maintenance ;
- Establishment of an automobile credit line for the purchase of tractors and small pick-ups for the processing centers and mobile units ;
- Establishment of a credit line for revolving funds.

7.2 Quality control

Quality control concerns more the construction of internal laboratories of quality control in order to ensure traceability of the seeds' products.

In addition to the jobs it will create in rural areas, quality control will generate wealth. A small simulation revealed that, in the irrigated systems, if 2,500 tons of seeds are certified, that would result on average in ensuring quality control over 500 hectares. At the actual price of 28,000 CFA Francs/ hectare for the field control by the TAs and 6,000 CFA Francs/ton for the laboratory control by the DRDRs/ SDDRs, that represents the amount of 29,000,000 CFA Francs. This unique case on irrigated rice could be extended to the other crops.

In rain-fed zones, quality control will be conducted by the TAs and the PAQs according to the ratio of 1 TA for 10 – 15 PAQs. The latter would benefit, like the TAs, from allowances paid by the farmers' organizations for the support they provide to them. It is difficult to presently know its amount because it is a matter of negotiations internal to each structure. However, experience has shown that this amount could be in certain cases 15,000 CFA Francs/ha for a cover of 100 hectares divided between five villages.

The conduct of decentralized controls should bring the DISEM to refocus its activities and get oriented towards other activities such as the:

- organization of contradictory controls ;
- training;
- development of pedagogical aids ;

- adaptation of the seeds regulation to the evolution of the production systems;
- conduct of contradictory controls.

7.3 Information management

The lack of reliable data at the sub sector level was revealed during the value chain analysis as a major constraint to improving the cereals productivity and competitiveness. The producers as well as the official departments (DA/DISEM, DRDRs, DAPS, etc) deplore this situation which seriously affects the marketing.

To remove this constraint, several information systems were initiated including the Système d'information des Marchés (MIS) - Markets Information System (MIS) created by FAO. This system is a tool of collection, processing and dissemination of practical and on-going agricultural information. Its objective is to put technical and commercial information at the disposal of the agricultural sector actors. It is built on a mechanism of Points d'Information Villageoise (VIP) -Village Information Points -established in the departments. This commercial information is disseminated through the rural radios, economic papers, Internet, posters boards, and producers meetings. They enable the producers to take good decisions and to improve their capacities of commercial negotiations.

The MIS has experienced an harmonious development in Senegal where it is feeding several information networks, particularly: (i) the platform for agricultural trade in West Africa (www.tradenet.biz) and its application (www.wa-agritrade.biz) ; (ii) the sub regional network of national Points d'Informations Commerciales Agricoles (PICA) –Points of Commercial Agricultural Informational - the West Africa Chambers of Agriculture (RECAO) ; (iii) the regional network of market information systems and agricultural trade in West Africa (www.mistowa.org) and (iv) the regional network of the West Africa markets information systems (www.resimao.org).

However, the MIS like most of the information networks is experiencing financing problems. In addition, the collection and dissemination of information on the agricultural products' prices are not regularly conducted.

With a view to removing these weaknesses and especially, to improving the access by the farmers and the private sector to a type of targeted information on the seeds and plants, a new information system was established in Ivory Coast. The system dubbed « Cyber-semence » - Cyber-seed, -- is hosted in the cooperatives which totally take in charge its operation (see Ivory Coast's observatory of the seeds and plants – www.ci-semences.com et www.coprocovida.ci-semences.com).

The Cyber-seeds also aim at promoting, through information on the seed, the stowing of traditional agriculture to the market system. They enable a regular monitoring of the performance of the farmers' organizations and each of their members. In fact, all the useful information regarding the seeds' productions and quality are recorded. This information concerns particularly:

- 1) the name of the seed producer;
- 2) the name of the quality agent farmer who conducted the routine controls;
- 3) The name of the TA working with the PAQ ;
- 4) The stocks localization ;
- 5) The quantities of seeds available per category ;
- 6) The quality of seeds produced per category.

The first Cyber-seeds were created in Ivory Coast following the drops in sales of rice and maize in the cooperative COPROCOVIDA (Coopérative de Commercialisation des Produits Vivriers de Daloa) - Cooperative for Marketing Food Products of Daloa - in 2004. The latter had accumulated an unsold stock of 600 tons of rice seeds Nerica and 200 tons of maize. And yet, during the same period, local and external

farmers' organizations (sub regional and regional) suffered from a chronic lack of quality seeds. Alternative solutions consisting of a support from the Ministry Agriculture departments, development projects and NGOs -- were attempted with little success.

This experience, although unsuccessful, nevertheless enabled to find certain recurrent facts: (i) a lack of information on the availability of seeds; (ii) a lack of information on the farmer requirements; (iii) a lack of information on the seed farms' activities; and (iv) a bad knowledge of the seed products' value.

Senegal, outside the irrigated zones, is encountering the same difficulties. The running of an observatory composed of Cyber-seeds installed in farmers' organizations and well structured cooperatives, should enable to noticeably improve the situation. The Cyber-seeds constitute a tool of collection and processing of data on the seeds based on the intervention of the TAs and PAQs who work in close collaboration with the DISEM, the DRDR and the SDDRs. They will complement the mechanism of collection and management of the statistics put in place at the DAPS with AfricaRice support.

The observatory management will be ensured by the private sector which will work to promote the agricultural products marketing. For this purpose, it could benefit from the support of the SAGIC / EGP of USAID and from other donors for a three-year period during which, information will be freely available. Afterwards, it will be billed at the price of 5 CFA Francs per kilogram of sold agricultural product. In the case of rice, the market could be:

- Whitish rice : $100,000 \text{ tons} \times 5 \text{ CFA Francs/kg} = 500,000,000 \text{ CFA Francs}$
- Rice seeds : $20,000 \text{ tons} \times 5 \text{ CFA Francs/kg} = 100,000,000 \text{ CFA Francs}$

Beyond the commercial function, the Cyber-seeds are a tool for promoting farmers' organizations particularly rural enterprises, and for developing client's loyalty through the traceability and the existence of a quality Label.

The Cyber-seeds also constitute an ideal framework for the practical education of producers and rural populations in the seeds area. It offer in other respects a channel of expression to the farmers' organizations / cooperatives to better take in account local realities such as the diversification and association of crops. These particularities of the African Agriculture were never integrated in the seeds' programs. It is the same for the local varieties which value yet can be increased through the fair trade, if they were the subject of ethno botanic studies and a production of quality seeds.

VIII. CONCLUSION

The value chain analysis shows that the seeds activity is profitable for the entire actors of the different segments particularly for the producers, processing centers and traders. It reveals three main niches of wealth and jobs generation, which offers important increment values. They concern in particularly the processing, and quality and information management.

In relation to the strategic options, Options 2 and 3 present interesting perspectives for the farmers' organizations as well as for the private sector which are invited to invest in the seeds sector at the national level, and to open themselves to the external and sub regional market. These options conform well to the unionization planned by the Government.

Regarding the processing centers in particular, it is possible to improve their profitability if they provide services such as the cleaning and grading of the agricultural products destined to industrial processing. However, specifications must be defined which limit the actual disturbances noted (lack of transparency in the management of funds, absence of depreciations, lack of maintenance, etc.). At this level, the UNIS role should be redefined.

The opening of the seeds processing to the private sector or to strong, reliable and well structured organizations could be profitable to the entire sub sector.

In relation to the personnel and the basic infrastructures, the PSAOP II of the World Bank and the SAGIC/EGP project of USAID offer financing possibilities which value deserves to be increased. For the heavy investments, the SAGIC /EPG project has a unit in charge of providing the necessary support through the establishment of lines of credit hosted in local banks.

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X. ANNEXES

Table 36: Types of farmers' organizations by agro ecological zone

Northern Zone (Senegal River Valley)			
Territorial Level	Types of farmers' organizations	Definition	Functions
1- Village	<ul style="list-style-type: none"> • Village sections of cooperatives • GIE, GPF • GIEs' unions and village sections • Farmer micro finance unions (Ronkh, Rao, Mpal, Mboumbaye, Diagambal) 	<ul style="list-style-type: none"> • Private companies of associative form including agricultural cooperatives of inputs purchase, common use of equipments, and production facilities, processing and marketing centers registered by the DA/MA • Economic interest groups with or no capital and registered in the Trade Register of the Regional Court • Mutual agricultural credit companies registered by the Ministry of Finance. 	<ul style="list-style-type: none"> • Access to credit ; • Supply of inputs and agricultural equipments • Production marketing • Financing of the agricultural campaigns.
2- Rural Community and inter community	<ul style="list-style-type: none"> • Agricultural cooperative • Agricultural NGOs • CLCOP 	<ul style="list-style-type: none"> • The local dialogue framework of the producers' organizations recognized by the MA is constituted by the delegates of the member OPs including the cooperatives, GIEs and others. 	<ul style="list-style-type: none"> • Representation and coordination at the community level • Defense of the grassroots organizations' interests.
3- Departmental	<ul style="list-style-type: none"> • Cooperatives departmental unions • Federation of GIEs and unions 	<ul style="list-style-type: none"> • The cooperatives departmental union is recognized by the MA and constituted by the cooperatives' delegates. Federations recognized by the MA local structures are constituted by the local unions' delegates 	<p>Representation and coordination at the departmental level; defense of the grassroots organizations' interests.</p>
- Regional	<ul style="list-style-type: none"> • Regional Unions of the agricultural cooperatives • CRCR or CRCOP • MDE and Directory of the Women involved in Livestock. 	<ul style="list-style-type: none"> • The cooperatives regional union is recognized by the MA and is constituted by the departmental unions' delegates. The Regional Framework for Rural Dialogue recognized by the Cadre National de Concertation des Ruraux (CNCR) the MA is constituted by the CLCOPs' delegates. 	<ul style="list-style-type: none"> • Representation and regional coordination; defense of the grassroots organizations' interests.
5- National	<ul style="list-style-type: none"> • Inter-professional Committees (CNIA, UNIS, CICL, CNIH) • CNCR • PPP 	<ul style="list-style-type: none"> • The inter-professional committees are recognized by the MA and concern the actors of the sub sectors' segments including OPs whereas the CNCR, constituted by the CRCRs' delegates want to be the OPs' interlocutor to the Government and international organizations. 	<ul style="list-style-type: none"> • Representation and national and international coordination; defense of the grassroots organizations' interests.

Southern Zone			
- Casamance			
1- Village	<ul style="list-style-type: none"> • Village section of cooperatives • GIE, GPF • GIEs unions and village sections • Inter- village committees • Valleys' Committees • Village associations • Youth associations • Farmers' unions of micro finance 	<ul style="list-style-type: none"> • Private companies of associative form including agricultural cooperatives of inputs purchase, common use of equipments and production facilities, processing and marketing centers registered by the DA/MA • Economic interest groups with or no capital and registered in the Trade Register of the Regional Court • Mutual agricultural credit companies registered by the Ministry of Finance. 	<ul style="list-style-type: none"> • Access to credit • Supply of inputs and agricultural equipments • Production marketing • Financing of the agricultural campaigns
2- Rural Community and inter community	<ul style="list-style-type: none"> • Agricultural cooperatives • Agricultural NGOs • CLCOP. 	<ul style="list-style-type: none"> • The local dialogue framework of the producers' organizations recognized by the MA is constituted by the OP member delegates including the cooperatives and others. 	<ul style="list-style-type: none"> • Representation and coordination at the community level • Defense of the grassroots organizations' interests.
3- Departmental	<ul style="list-style-type: none"> • Cooperatives departmental unions • Federations of associations • Federations of GIEs and unions 	<ul style="list-style-type: none"> • The cooperatives departmental union is recognized by the MA and constituted by the cooperatives' delegates. Federations recognized by the MA local structures are constituted by the local unions' delegates. 	<ul style="list-style-type: none"> • Representation and coordination at the departmental level; defense of the grassroots organizations' interests.
4- Regional	<ul style="list-style-type: none"> • Regional union of agricultural cooperatives • CRCR or CRCOP 	<ul style="list-style-type: none"> • The cooperatives regional union is recognized by the MA departmental unions. The CRCR recognized by the MA is constituted by the CLCOPs' delegates. 	<ul style="list-style-type: none"> • Representation and regional coordination is constituted by the delegates; defense of the grassroots organizations' interests.
5- National	<ul style="list-style-type: none"> • Inter-professional committees (CNIA, UNIS, CICL, CNIH) • CNCR 	<ul style="list-style-type: none"> • The inter-professional committees are recognized by the MA and concern the actors of sub sectors' segments including OPs whereas the CNCR, constituted by the CRCRs' delegates wants to be the OPs interlocutor to the Government and international organizations. 	<ul style="list-style-type: none"> • Representation and national and international coordination; defense of the grassroots organizations' interests.

Central zone			
1- Village	<ul style="list-style-type: none"> • Village section of cooperatives • GIE • GPF • GIE unions and village section • Farmers' unions of micro finance 	<ul style="list-style-type: none"> • Private companies of associative form including agricultural cooperatives of inputs purchase, common use of equipments production facilities, processing and marketing centers registered by the DA/MA • Economic interest groups with or no capital and registered in the Trade Register of the Regional Court • Mutual agricultural credit companies registered by the Ministry of Finance. 	<ul style="list-style-type: none"> • Access to credit • Supply of inputs and agricultural equipments • Production marketing ; • Financing of the agricultural campaigns.
2- Rural Community and inter community	<ul style="list-style-type: none"> • Agricultural cooperatives • Agricultural NGOs • CLCOP 	<ul style="list-style-type: none"> • The local dialogue framework of the producers' organizations recognized by the MA is constituted by the OP member delegates including the cooperatives, GIEs and others. 	<ul style="list-style-type: none"> • Representation and coordination at the community level; defense of the grassroots organizations' interests
3- Departmental	<ul style="list-style-type: none"> • Cooperatives departmental unions • Federations of GIEs and unions 	<ul style="list-style-type: none"> • The cooperatives regional union is recognized by the MA and constituted by the cooperatives' delegates. Federations recognized by the MA local structures are constituted by the local unions' delegates. 	<ul style="list-style-type: none"> • Representation and coordination at the departmental level; defense of the grassroots organizations' interests.
4- Regional	<ul style="list-style-type: none"> • Regional unions of agricultural cooperatives • CRCR or CRCOP • MDE and Directorate of Women involved in Livestock 	<ul style="list-style-type: none"> • The cooperatives regional union recognized by the MA is constituted by the departmental unions' delegates. The CRCR recognized by the MA is constituted by the CLCOPs' delegates. 	<ul style="list-style-type: none"> • Representation and regional coordination; defense of the grassroots organizations' interests.
5- National	<ul style="list-style-type: none"> • Inter-professional committees (CNIA, UNIS, CCPA, CICL, CNIH) • CNCR 	<ul style="list-style-type: none"> • The inter-professional committees are recognized by the MA and concern the actors of sub sectors' segments including OPs whereas the CNCR, constituted by the CRCRs' delegates wants to be the OPs interlocutor to the Government and international organizations. 	<ul style="list-style-type: none"> • Representation and national and international coordination; defense of the grassroots organizations' interests.

Tableau 37: Operating account of the production of one hectare of foundation seeds

Expenses		Quantity	Unit Price	CFA Francs/ha
1.	Soil preparation			
1.1.	Offsetting	1	23,000	23,000
1.2.	Manual maintenance	1	3,200	3,200
	<i>Sub-total</i>			<i>26,200</i>
				<i>Soil Preparation</i>
2.	Seeds			
2.1.	Foundation seeds	120	750	90,000
	<i>Sub-total</i>			<i>90,000</i>
				<i>Seeds</i>
3.	Inputs			
3.1.	Fertilizers			
	DAP (18-46-00)	100	400	40,000
	Urea (46-00-00)	300	210	63,000
3.2.	Crop protection products			
	Propanyl	8	3,500	28,000
	2,4D (weed one)	2	3,500	7,000
	Furadan	5	2,000	10,000
	<i>Sub-total</i>			<i>148,000</i>
				<i>Inputs</i>
	Irrigation (costs paid to the Union)			
4.	4.1. Bill	150	500	75,000
	4.2. Maintenance and spare parts			0
	4.3. Salaries of pumping agents + guards	1	6,667	6,667
	4.4. Depreciation of Motor Pump Generator	1	30,000	30,000
	<i>Sub-total</i>			<i>111,667</i>
				<i>Irrigation (costs paid to the Union)</i>
5.	Labor			
5.1.	Labor (purification + maintenance)	1	50,000	50,000
5.2.	Labor (seasonal +staking)	1	70,000	70,000
5.3.	Winnowing, bagging	1	14,000	14,000
	<i>Sub-total</i>			<i>134,000</i>
				<i>Labor</i>
6.	Mechanical threshing			
6.1.	Threshing 10%	560Kg		
	<i>Sub-total</i>			
				<i>Threshing</i>
	Other costs			
7.	7.1. Transportation of inputs (3500 CFA Francs/ton)	1,00	3,500	3,500
	7.2. Bags (renewal every five years)	70	350	24,500
	7.3. Transportation of harvested seeds	70	350	24,500
	7.4. OMVS Fees	1	1,800	1,800
	FOMAED	1	12,500	12,500
	Irrigation equipment+ miscellaneous	1	25,850	25,850

	Renovation of the developments	1	15,000	15,000
	Management costs	1	3,500	3,500
	Handling	70	150	10,500
7.5	Depreciation of sprayer (5 years for 5 hectares/year)	1	2,700	2,700
7.6	Field control costs	1	28,000	28,000
	<i>Sub-total</i>			152,350
	<i>Other costs</i>			
	Financial costs			
8.	8.1. FF: 12%/year over 9 months	9.8%	293,150	28,729
	<i>Sub-total</i>			28,729
	TOTAL COSTS			690,946
	Products	5040	190	957,600
	Margin			266,654

Table 38: Operating account of one ton of processed foundation seeds

COSTS	Quantity	Unit Price	CFA Francs/ha
Raw seeds	1,000	190	190,000
Processing bags	22	250	5,500
Handling of raw seeds	26 (13x2)	75	1,950
Transportation of raw seeds	13	500	6,500
Handling of certified seeds	0.880x3	700	1,848
Transportation of certified seeds	0.88	7,000	6,160
Crop protection practices	0.88		6,400
Processing	1	5,500	5,500
Sorting chain labor	1	3,000	3,000
Certification licenses	22	40	880
Financial costs			22,318
Total costs			250,056
Products	880	400	352,000
Margin			101,944

Table 39: Operating account of the production of one hectare of seeds R1

EXPENSES		Quantity	Unit Price	CFA Francs/ha
1.	Soil preparation			
1.1.	Offsetting	1	23,000	23,000
1.2.	Manual maintenance	1	3,200	3,200
<i>Sub-total</i>				<i>26,200</i>
2.	Seeds			
2.1.	Seeds R1	120	400	48,000
<i>Sub--total</i>				<i>48,000</i>
3.	Inputs			
3.1.	Fertilizers			
	DAP (18-46-00)	100	400	40,000
	Urea(46-00-00)	300	210	63,000
3.2.	Crop protection products			
	Propanyl	8	3,500	28,000
	2,4D (weed one)	2	3,500	7,000
	Furadan	5	2,000	10,000
<i>Sub-total</i>				<i>148,000</i>
Irrigation (costs paid to the Union)				
4.	4.1. Bills	150	500	75,000
	4.2. Maintenance and spare parts			
	4.3. Salaries and pumping agents + guards	1	6,667	6,667
	4.4. Depreciation of Motor Pump Generator	1	30,000	30,000
<i>Sub-total</i>				<i>111,667</i>
5.	Labor			
5.1.	Labor (purification + maintenance)	1	50,000	50,000
5.2.	Labor (seasonal + staking)	1	70,000	70,000
5.3.	Winnowing, bagging	1	14,000	14,000
<i>Sub-total</i>				<i>134,000</i>
6.	Mechanical threshing			
6.1.	Threshing 10%	560Kg		
<i>Sub-total</i>				
Other costs				
7.	7.1. Transportation of inputs(3500 CFA Francs/ton)	1	3,500	3 500
	7.2. Bags (renewal every 5 years)	70	350	24,500
	7.3. Transportation of harvested seeds	70	350	24 500
	7.4. OMVS Fees	1	1,800	1,800

	FOMAED	1	12,500	12,500
	Irrigation equipment+ miscellaneous	1	25,850	25,850
	Renovation of developments	1	15,000	15,000
	Management fees	1	3,500	3,500
	Handling	70	150	10,500
7.5	Depreciation of sprayer (5 years for 5 hectares/year)	1	2,700	2,700
7.6	Field control costs	1	28,000	28,000
	<i>Sub-total</i>			<i>152,350</i>
	<i>Other costs</i>			
	Financial costs			
8.	8.1. FF: 12%/year over 9 months	9.8%	293,150	28,729
	<i>Sub-total</i>			<i>28,729</i>
	TOTAL COSTS			648,946
	Production	5,040	180	907,200
	Margin			258,254

Table 40: Operating account of one ton of seeds R1

EXPENSES	Quantity	Unit Price	CFA Francs/ha
Raw seeds	1000	180	180,000
Processing bags	22	250	5,500
Handling of raw seeds	26 (13x2)	75	1,950
Transportation of raw seeds	13	500	6,500
Handling of certified seeds	0,880x3	700	1,848
Transportation of certified seeds	0,88	7,000	6,160
Crop protection practices	0,88		6,400
Processing	1	5,500	5,500
Sorting chain labor	1	3,000	3,000
Certification licenses	22	40	880
Financial costs			21,338
Total costs			239,076
Products	880	325	286,000
Margin			46,924

Table 41: Operating account of the production of one hectare of seeds R2

Expenses		Quantity	Unit Price	CFA Francs/ha
1.	Soil preparation			
1.1.	Offsetting	1	23,000	23,000
1.2.	Manual maintenance	1	3,200	3,200
	<i>Sub-total</i>			<i>26,200</i>
	<i>Soil preparation</i>			
2.	Seeds			
2.1.	Seeds R2	120	300	36,000
	<i>Sub-total</i>			<i>36,000</i>
	<i>Seeds</i>			
3.	Inputs			
3.1.	Fertilizers			
	DAP (18-46-00)	100	400	40,000
	Urea (46-00-00)	300	210	63,000
xx 3.2.	Crop protection products			
	Propanyl	8	3,500	28,000
	2,4 D (weed one)	2	3,500	7,000
	Furadan	5	2,000	10,000
	<i>Sub-total</i>			<i>148,000</i>
	<i>Inputs</i>			
	Irrigation (costs paid to the Union)			
4.	4.1. Bills	150	500	75,000
	4.2. Maintenance and spare parts			
	4.3. Salaries of pumping agents + guards	1	6,667	6,667
	4.4. Depreciation of Motor Pump Generator	1	30,000	30,000
	<i>Sub-total</i>			<i>111,667</i>
	<i>Irrigation (costs paid to the Union)</i>			
5.	Labor			
5.1.	Labor (purification + maintenance)	1	50,000	50,000
5.2.	M.O. (seasonal + staking)	1	70,000	70,000
5.3.	Winnowing, bagging	1	14,000	14,000
	<i>Sub-total</i>			<i>134,000</i>
	<i>Labor</i>			
6.	Mechanical threshing			
6.1.	Threshing 10%	560Kg		
	<i>Sub-total</i>			
	<i>Threshing</i>			
	Other costs			
7.	7.1. Transportation of inputs(3500 CFA Francs/ton)	1	3,500	3,500
	7.2. Bags (renewal every 5 years)	70	350	24,500
	7.3. Transportation of harvested seeds	70	350	24,500
	7.4. OMVS Fees	1	1,800	1,800
	FOMAED	1	12,500	12,500
	Irrigation equipment + miscellaneous	1	25,850	25,850

	Renovation of developments	1	15,000	15,000
	Management fees	1	3,500	3,500
	Handling	70	150	10,500
7.5	Depreciation of sprayer (5 years for 5 hectares/year)	1	2,700	2,700
7.6	Field control costs	1	28,000	28,000
<i>Sub-total</i>				<i>152,350</i>
Financial costs				
8.	8.1. FF: 12%/year over 9 months	9.8%	293,150	28,729
<i>Sub-total</i>				<i>28,729</i>
TOTAL COSTS				636,946
Products		5,040	170	856,800
Margin				219,854

Table 42: Operating account of one ton of seeds R2

COSTS	Quantity	Unit Price	CFA Francs/ha
Raw seeds	1,000	170	170,000
Processing bags	22	250	5,500
Handling of raw seeds	26 (13x2)	75	1,950
Transportation of raw seeds	13	500	6,500
Handling of certified seeds	0.880x3	700	1,848
Transportation of raw seeds	0.88	7,000	6,160
Crop protection practices	0.88		6,400
Processing	1	5,500	5,500
Sorting chain labor	1	3,000	3,000
Certification licenses	22	40	880
Financial costs			20,358
Total costs			228,096
Products	880	300	264,000
Margin			35,904

Table 43: Production costs of sorghum foundation seeds

Items	Cost of 1 hectare (CFA Francs)
Soil preparation	30, 710
Inputs	122, 000
Sowing	99, 875
Weeding	127, 840
Harvest	55, 650
Threshing	67, 025
Processing	90, 960
Total	594, 060

Table 44: Production costs of millet foundation seeds

Items	Cost of 1 hectare (CFA Francs)
Soil preparation	30, 710
Inputs	111, 300
Sowing	28, 880
Weeding	153, 640
Harvest	560, 720
Threshing	66, 770
Processing	81, 960
Total	1, 042 ,950

Table 45: Production costs of maize foundation seeds

Items	Cost of 1 hectare (CFA Francs)
Soil preparation	40, 000
Inputs	100, 000
Sowing	50, 000
Weeding	150, 000
Guarding	150, 000
Harvest	560, 000
Threshing	100, 000
Processing	100, 000
Total	1, 260, 000

Table 46: Production costs of irrigated rice foundation seeds

Items	Requirements(CFA Francs)
Soil Preparation	391, 000
Inputs	1, 015, 000
Pre-irrigation	460, 000
Fuel/lubricants	495, 000
Sowing	267, 000
Weeding	1, 102, 000
Guarding	1, 600, 000
Harvest	410, 000
Threshing	538, 500
Processing	599, 500
Allowances of technicians and drivers	710, 000
Total	7, 587, 000

Table 47: Production costs of foundation seeds of rain-fed lowland rice

Items	Requirements (CFA Francs)
Labor (sowing, weeding, guarding, harvest, threshing)	1, 000, 000
Inputs	200, 000
Fuel/lubricants	500, 000
Processing	100, 000
Allowances of researchers, technicians and drivers	200, 000
Total	2, 000, 000

Table 48: Certified seed requirements by species (2009 - 2012)

Species		Peanut	Rice	Maize	Millet	Sorghum	Cowpeas	Fonio	Wheat	Sesame
Consumption production objectives (tons)		1, 000, 000	1, 200, 000	2, 000, 000	1, 000, 000	500, 000	450, 000	5, 000	25, 000	50, 000
% of the certified seed requirements		33%	80%	25%	25%	25%	25%	25%	50%	50%
Years	Categories									
2009	Foundation seeds	40		0.1	0.02	0.032	0.1	0.05	0.2	0.012
	Registered seeds	400	384	12.5	4	2	1			0.85
	R1		11, 060							
	R2									
	Ordinary seeds	40, 000	8, 140	2, 500	1, 000	500	2, 500	42.5	-	150
	Total	40, 440	19, 592	2, 512.600	1, 004.02	502.032	2, 501.10	42.55	0.2	150.862
2010	Foundation seeds	40	8	0.1	0.02	0.032	0.1	0.05	0.2	0.012
	Registered seeds	400	384	12.5	4	2	1	1.5	5	0.85
	R1	4, 000	19, 200	2, 500	1, 000	500	56	-	125	150
	R2									
	Ordinary seeds	36, 000					2 500	42,500	-	
	Total	40, 440	19, 592	2, 512.600	1, 004.02	502.032	2, 557.10	44.05	130.2	150.862
2011	Foundation seeds	40	8	0.1	0.02	0.032	0.1	0.05	0.2	0.012
	Registered seeds	400	384	12.5	4	2	1	1.5	5	0.85
	R1	4, 000	19, 200	2, 500	1, 000	500	56	42.5	125	150
	R2	36, 000					2, 500		3, 125	
	Ordinary seeds									
	Total	40, 440	19, 592	2, 512.600	1, 004.02	502.032	2, 557.10	44.05	3, 255.200	150.862
2012	Foundation seeds	40	8	0.1	0.02	0.032	0.1	0.05	0.2	0.012
	Registered seeds	400	384	12.5	4	2	1	1.5	5	0.85
	R1	4, 000	19, 200	2, 500	1, 000	500	56	42.5	125	150
	R2	36 000					2, 500		3, 125	
	Ordinary seeds									
	Total	40, 440	19, 592	2, 512.600	1, 004.02	502.032	2, 557.10	44.05	3, 255.200	150.862

Table 49: Input requirements (2009 – 2012)

YEARS	SPECIES	PEANUT	RICE	MAIZE	MILLET	SORGHUM	COWPEAS	FONIO	WHEAT	SESAME
2009	Seeds production objectives (Tons)	440	11,452	2,512.60	1,004	502	2,557	42.5	0.2	150.9
	Areas to be cultivated (hectares)	370	1,910	630	800	130	2,550	60	1	220
	Multiplication seed requirements (Tons)	45	230	12.6	3.2	1	51	1.5	150	0.9
	Fertilizers' NPK requirements (Tons)	55.5	191	126	120	19.5	255	6	0.2	22
	Urea requirements (Tons)	-	573	126	80	13	-	3	0.1	11
2010	Seeds production objectives (Tons)	4,440	19,592	2,512.60	1,004	502	2,557	42.5	130.2	150.9
	Areas to be cultivated (hectares)	3,700	3,265	630	800	130	2,550	60	35	220
	Multiplication seed requirements (Tons)	440	392	12.6	3.2	1	51	1.5	5.3	0.9
	Fertilizers' NPK requirements (Tons)	555	326.5	126	120	19.5	255	6	7	22
	Urea requirements (Tons)	-	979.5	126	80	13	-	3	3.5	11
2011	Seeds production objectives (Tons)	40,440	19,592	2,512.60	1,004	502	2,557	42.5	3,255.20	150.9
	Areas to be cultivated (hectares)	37,000	3,265	630	800	130	2,550	60	850	220
	Multiplication seed requirements (Tons)	440	392	12.6	3.2	1	51	1.5	128	0.9
	Fertilizers' NPK requirements fertilizers (Tons)	555	326.5	126	120	19.5	255	6	170	22
	Urea requirements(Tons)	-	979.5	126	80	13	-	3	85	11
2012	Seeds production objectives (Tons)	40,440	19,592	2,512.60	1,004	502	2,557	42.5	3,255.20	150.9
	Areas to be cultivated (hectares)	37,000	3,265	630	800	130	2,550	60	850	220
	Multiplication seed requirements (Tons)	440	392	12.6	3.2	1	51	1.5	128	0.9
	Fertilizers NPK requirements (Tons)	555	326.5	126	120	19.5	255	6	170	22
	Needs in urea (Tons)	-	979.5	126	80	13	-	3	85	11

Table 50: Truck farming seed requirements

Species		Onion	Potato	Tomato	Okra	Cassava	Sweet potato	Bissap
Production objectives (tons)		150,000	10,500	30,000	21,120	3,000,000	120,000	2,000
Certified seed requirements (kilogram)		3,600	1,960,000	360	13,000	250,000,000	160,320,000	20,000
Years	Categories							
2009	Foundation seeds	40	78,000	0.014	1.32	3,906,250	314,000	2
	Registered seeds							
	R1							
	R2							
	Ordinary seeds					250,000,000		
	Total	40	78,000	0.014	1.32	253,906,250	314,000	2
2010	Foundation seeds	40	78,000	0.014	1.32	3,906,250	314,000	2
	Registered seeds	120	392,000	2.25	132	15,625,000	2,505,000	200
	R1							
	R2							
	Ordinary seeds					250,000,000		
	Total	160	470,000	2.264	133.32	269,531,250	2,819,000	202
2011	Foundation seeds	40	78,000	0.014	1.32	3,906,250	314,000	2
	Base	120	392,000	2.25	132	15,625,000	2,505,000	200
	R1	36,000	1,960,000	360	13,000	62,500,000	20,040,000	20,000
	R2							
	Ordinary seeds					250,000,000		
	Total	36,160	2,430,000	362.264	13,133.32	32,031,250	22,859,000	20,202
2012	Foundation seeds	40	78,000	0.014	1.32	3,906,250	314,000	2
	Registered seeds	120	392,000	2.25	132	15,625,000	2,505,000	200
	R1	36,000	1,960,000	360	13,000	62,500,000	20,040,000	20,000
	R2					50,000,000	160,320,000	
	Ordinary seeds							
	Total	36,160	2,430,000	362.264	13,133.32	332,031,250	183,179,000	20,202

U.S. Agency for International Development

1300 Pennsylvania Avenue, NW

Washington, DC 20523

Tel: (202) 712-0000

Fax: (202) 216-3524

www.usaid.gov