Chapter 12

Smallholder participation in value chains: The case of domestic rice in Senegal*

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1. Introduction

Since 1985, rice production in West Africa has doubled, but consumption of rice has increased even more rapidly. This has resulted in the increasing dependence of West African countries on rice imports (Seck *et al.*, 2010). Rice is the most consumed cereal in Senegal (about 1.1 million tonnes in 2009). However, only 45 percent of consumption is covered by domestic production; the rest is imported from India, Thailand, and Viet Nam (FAO, 2011). This large import dependency makes Senegal vulnerable to volatility in the international rice market (Seck *et al.*, 2010). In response to the 2008 food crisis, the government in Senegal has placed rice on higher priority for self-sufficiency and increased investments to boost production. However, to successfully achieve self-sufficiency, Senegal will not only have to invest in productivity (supply push), but will need to tackle the demand side as well (demand pull). One of the major challenges will consist of linking smallholder farmers to large urban consumption markets by: (i) increasing marketable surplus; (ii) consolidating supply; and (iii) adapting quality of rice to conform to urban consumer standards (Demont and Rizzotto, 2012).

In this chapter we analyse current and potential participation of smallholders in rice value chains in Senegal. We formulate policy recommendations to reduce the constraints for smallholder market participation, especially with respect to integration in the rapidly growing urban markets.

2. Overview of consumption, production and trade

Before starting a more detailed analysis of the value chain of rice, we give a short overview of the production and consumption patterns, the imports and the national policies in the Senegalese rice sector.

2.1 Consumption

Since the 1980s, rice consumption has surpassed the consumption of more traditional crops such as sorghum and millet and has become the main staple food consumed in Senegal (Table 1). In 2005 the consumption of rice was 68.5 kg per capita, compared to 42.3 kg in 1975.[2] More than 30 percent of the daily calorie intake in Senegal currently comes from rice.

Table 1. Consumption of cereals and share of total calorie intake in Senegal in 1975, 1990 and 2005

	1975		1990		2005	
	kg/cap/yr	% of kcal	kg/cap/yr	% of kcal	kg/cap/yr	% of kcal
Millet	89.3	28.4	58.3	18.4	21	6.4
Rice	42.3	19.7	62.1	28.5	68.5	30.8
Sorghum	23.6	8.9	17.2	6.4	10.2	3.7
Wheat	18.5	6.4	25.5	8.7	29	9.6
Maize	10.3	4	15.9	6.1	33.8	12.6
Total kcal/cap/day	2,109		2,135		2,199	

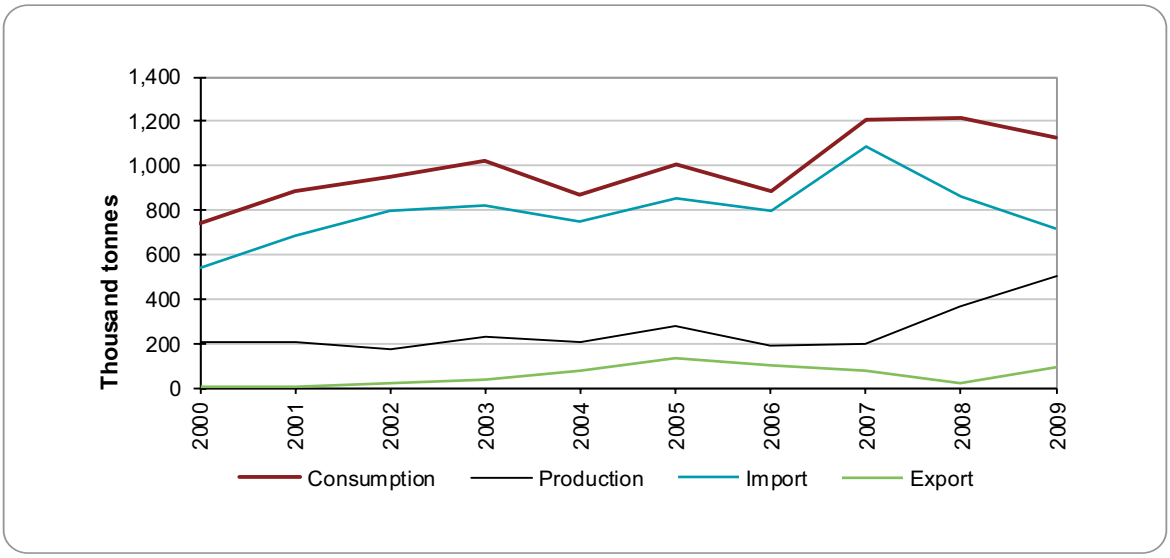
Source: FAOSTAT (2010)

[2] By 2013, these consumption rates have reached 86.6 kg per capita.

This shift towards rice consumption began with the large and cheap imports of broken rice from the French colonies in Asia during the period of the French administration. The low processing and cooking costs of rice and the popularity of street-vendor sales of rice dishes enhanced the preference for rice in urban areas (Reardon, 1993). However, the shift to rice and especially the preference for broken rice—which is considered an inferior product on the international market—is much more pronounced in urban than in rural areas. As population growth is especially strong in urban areas, it is clear that urban consumption patterns have had and will continue to have an important impact on national demand and trade.

Today, Senegalese rice consumption still largely exceeds domestic production, but important shifts are taking place (Figure 1). Up to 2007, rice demand and imports had been increasing because of population growth, increasing incomes, urbanization and the increasing share of rice in the Senegalese diet. However, since the 2008 food crisis, domestic production is progressively overtaking rice imports.

Figure 1. Consumption, production and trade of rice in Senegal, 2000–2009



Source: FAOSTAT (2011) and ANSD (2006–2009)
Note: Consumption is calculated as production plus imports, minus exports.

2.2 Production

During the food crisis in 2008, import prices of rice increased sharply. This led to high domestic prices for local rice and promoted important area expansion and increased double cropping.[1] Together with good weather conditions, these resulted in a boost to domestic production in 2008. Rice is produced almost exclusively by smallholder farmers. Senegal's rice production consists of two major rice production systems in two different ecosystems and yields vary significantly between these systems (Rodenburg and Demont, 2009).

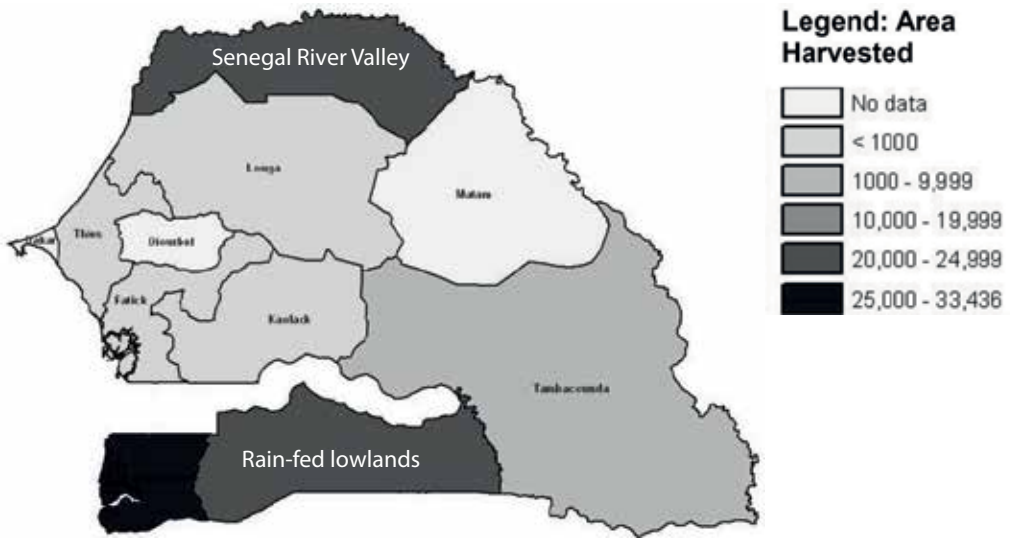
First—and most important in terms of commercial rice—are the irrigated production systems which are situated primarily in the Senegal River Valley (SRV) in the regions of Saint-Louis, Podor and Matam (Figure 2). Seventy percent of national rice production is irrigated rice and yields reach an average of 5 to 6 tonnes/ha. Several public investment schemes have contributed to the development of large-scale irrigation schemes (GA – *grands aménagements*) and village irrigation schemes (PIV – *périmètres*

[1] Double cropping refers to the production of rice both in the rainy and in the dry season, resulting in two harvests per year.

irrigués villageois). In addition, after the disengagement of the government from the rice industry, private investors built private irrigation schemes (PIP – *périmètres irrigués privés*) in the Senegal River Valley.

Second, rain-fed lowland (*bas-fond*) rice cultivation is concentrated in the southern region of Casamance, and in the central and eastern regions of Fatick and Kaolack which together form the largest areas of rice cultivation. Rain-fed production contributes around 30 percent of national rice production and is based on very small plots (less than 0.1 ha). Average yields, at 1 to 2 tonnes/ha, are much lower than in the SRV.

Figure 2. Rice area harvested by region



Source: USAID (2009), based on harvest data from Centre Régional Agrhymet, 2000.

2.3 Import and export

Thailand used to be the main provider of rice to Senegal with some 42 percent share in 2010. Since then, Thailand's share has fallen to 11.5% in 2012. Brazil, India,Pakistan and Viet Nam account for smaller imports of rice. More than 95 percent of Senegalese imports are of broken rice. With 22 percent of the world market, Senegal is the largest market for broken rice worldwide (USAID, 2009).

Rice exports from Senegal are small; they mainly consist of the re-export of imported rice to neighbouring countries. In addition, there is some unreported export of rice to neighbouring countries, mainly along the border with Mauritania. The Senegalese government estimates that volumes of informal rice exports correspond to 20–30 percent of official exports (USAID, 2009).

2.4 National rice policies

In 1994, after a period of heavy state involvement, Senegal started to liberalize its rice sector as part of its Structural Adjustment Program. The state disengaged from processing and marketing activities in 1994. In 1995 the state discontinued setting support prices for paddy[3] rice. The parastatal agency, SAED (Société

[3] 'Paddy rice' (sometimes called rough rice) is the term used for rice that is obtained by threshing after harvest, but still contains the husk surrounding the rice grain. Through the milling process, the husk is removed and the 'paddy' is converted into 'milled rice.'

d'Aménagement et d'Exploitation des terres du Delta et des vallées du fleuve Sénégal et de la Falémé), which was responsible for management and commercialization of SRV rice in the pre-reform period, was converted during the mid-1990s into an independent organization responsible for technical assistance and the maintenance of irrigation infrastructure.

In 2000, the Senegalese government adopted a new vision for the development of agriculture, including the Strategy of Accelerated Growth (SCA - *Stratégie de Croissance Accélérée*) which aims to reduce poverty by 50 percent by 2015 and achieve the Millennium Development Goals. In 2005 the Senegalese president set a target of 1.5 million tonnes of paddy rice (equivalent to 1 million tonnes of white rice) produced by 2015 in order to reach self-sufficiency (PNAR –*Programme National d'Autosuffisance en Riz*).

In April 2008, the president launched the GOANA program (*Grande Offensive Agricole pour la Nourriture et l'Abondance*) in order to achieve this ambitious target. This program implements massive investments in the national rice sector, notably by irrigating and cultivating unused land in the SRV and intensifying production of rice through double cropping. The program reaffirmed the 1.5 million tonnes of paddy rice to be produced by 2015 (MoA, 2008). Additional components of the program include: (i) input subsidies; (ii) provision of certified seed; (iii) financing of production and post-harvest machinery; and (iv) creation of a private sector marketing agency responsible for collecting, processing and marketing local rice production.

Over the past decades, state involvement in the import of rice has also decreased, and trade policies have become more liberalized. While import of rice is now organized by the private sector, until 1995 the Senegalese government had a monopoly on imports of broken rice and all rice imports were subject to a quota. In 1994, when the currency was devalued, tariffs were reduced from 38 percent to 16 percent (Lançon and Benz, 3007). In 2000 the Common External Tariff of the West African Economic and Monetary Union was implemented; this consists of a fixed duty equivalent to a 12.7 percent *ad valorem* tariff (Masters, 2007). Given the large dependence on imports, it is not surprising that Senegal's import tariffs are relatively low. Compared to other major rice-importing West African countries, such as Nigeria and Ghana, Senegal applies much lower border protection. In response to the food crisis in 2007–2008, Senegal temporarily eliminated tariffs and even subsidized imports to keep prices low. Exports were prohibited and consumer prices were fixed (Aker *et al*., 2009).

2.5 Farmer organizations

Rice farmers in the SRV region are organized into a structure of farmer organizations that are primarily involved in land management, provision and reimbursement of credit, purchase of inputs for rice farming, and management and maintenance of the irrigation infrastructure.

In order to have access to credit from the agricultural bank (CNCAS—*Caisse National de Crédit Agricole du Sénégal*), farmers need to be organized in an Economic Interest Group (GIE—*Groupement d'Intérêt Economique*). A GIE can consist of several farmers or one larger individual farmer. These GIEs are usually part of village-level unions (UV - *Unions Villagois*), which are headed by a president and assisted by a secretary-general and a treasurer, and which - at their turn - are part of larger farmer organizations or federations.

The demand for credit is collectively formulated at the level of the GIE and transmitted to the UV, which submits the collective requirements to the CNCAS - after the submission is approved by the former parastatal SAED. The credit can be used for purchasing inputs (fertilizers, pesticides and seeds) which are distributed among the members.

Each year, CIRIZ (*Comité Interprofessionnel du Riz*), a committee of farmers, farmer organizations, CNCAS and SAED representatives, determines a reference paddy price for the reimbursement of loans. Based on this price, farmer organizations calculate the number of paddy rice bags they must recover from farmers in order to repay the loan. After harvest, each GIE collects the corresponding volumes of rice, which is sold to traders by the GIE itself or by the UV, either as paddy rice or milled.

Most GIEs and unions do not engage in any more advanced form of processing or storage of rice and most of them sell the rice as paddy immediately after harvesting. Even at higher levels, such as village unions and federations, involvement of farmer organizations in processing and marketing is limited. With some exceptions such as the well-organized union of female rice growers in Ross Béthio, a few strong village-level unions, and the PINORD platform (see below), these organizations do not engage in collective processing and marketing beyond the sale of rice for loan repayments.

2.6. Consumer preferences

Consumer preferences differ significantly across urban and rural markets. In both markets there are four rice types: broken, intermediary, whole and ungraded rice. Senegalese consumers a high degree of preference for broken rice, but this preference is much more pronounced in urban markets than in rural markets (Rutsaert *et al.*, 2013). Especially in Dakar, consumers are accustomed to imported, aromatic broken rice. In semi-urban centres located in the SRV rice-producing region, such as Saint-Louis and Podor, consumers are familiar with local rice and most of them prefer it to imported rice. In these semi-urban centres, the preference for broken rice is much less pronounced than in Dakar, but still higher than in rural areas. In rural areas, whole grain rice is much more appreciated and only 10 percent of rural rice consumption is imported. Rural consumers often purchase ungraded rice, and do the sorting into broken, intermediate and whole grains at home.

The preference for broken imported rice among the large - and growing - group of urban consumers, clearly does not match the objective of reducing the import dependence by increasing domestic production. Fall *et al*. (2007) analysed the opinions of sellers, consumers and producers on the reasons for the weak position of local rice in urban markets. While producers mainly blame unfair competition from Asian rice as well as difficulties selling their surplus production, consumers and sellers emphasize differences in quality and poor marketing of domestic rice.

3. Supply chains of rice

The previous section shows there is a strong segmentation of markets, corresponding to different consumer preferences. This is consistent with the fact that the supply chains of rice in Senegal are organized separately for imported and domestic rice, with very little overlap; only a few actors - some large traders in the urban areas- are involved in both supply chains. In addition, domestic rice production systems are very different in the SRV from those in the southern regions.

In the following section we analyse the supply chains of imported and domestic rice, both in the SRV and in southern Senegal. For imported rice, we briefly describe how imports and commercialization are organized. For domestically produced rice, we describe the functioning of input markets, the organization of rice production and processing, and whether - and through which channels - rice is commercialized.

3.1 Import market chain

Given that 65 percent of rice consumed is sourced abroad, the import market chain is the most important one in terms of volume. Imported rice dominates the rice market in Dakar and in some of the other large cities.

In 1996, 43 importers were active in the Dakar market. After significant consolidation during the past decade, there are currently only about ten regular importers, and four of them are responsible for 66 percent of the imports (USAID, 2009). Large importers buy huge quantities (ships) of rice, while a number of smaller importers buy rice by the container. Rice is then sold to wholesalers in Dakar. An important share of imported rice passes through only four large wholesalers and is then distributed to semi-wholesalers and finally to retailers and small shops in Dakar and towns further inland. Often semi-wholesalers also own trucks and organize the transport.

3.2 Domestic rice channel: Senegal River Valley

As described earlier, virtually all of the marketed domestic rice is produced in the SRV. A state run monopoly supplies subsidized fertilizer, sold at 40 percent below the market price. A number of private actors are authorized to multiply seeds, which must then be tested by public laboratories and conditioned in Seed Sorting Centers (USAID, 2009). In order to obtain credit from the agricultural bank (CNCAS) farmers are required to be part of a GIE and to use certified seed. In addition to this system of subsidized credit through GIEs, private lenders may provide credit at substantially higher interest rates. While the organization of credit provision through GIEs facilitates farmers' access to credit, the monopoly of the agricultural bank, and of the state-run supplier of fertilizer and seed, along with the associated bureaucracy, results in an inefficient provision of inputs.

After the rice for credit reimbursement is collected by the GIE, each individual farmer chooses what to do with the remainder of his production. Overall, about one third of SRV rice is sold collectively for the reimbursement of credit, one third is sold individually to small traders and one third is kept for consumption (USAID, 2009).

Transformation of paddy into rice happens through two parallel processing systems. Small, informal mills, often at the village level, simply process paddy to rice by removing the husk of the grain. However, in response to higher prices and demand for quality from urban end-markets, larger semi-industrial mills are expanding capacity to produce processed rice. Both types of rice mills usually act as service providers. Farmers or (more often) traders bring the paddy to the mills and pay a fixed amount per tonne for milling.

Most farmers sell paddy or rice through small, informal intermediary traders (*banabanas*). These traders often buy small quantities of paddy at the field and process them through the small village mills. They sell the rice at weekly markets in the interior of the country, or to wholesalers in the cities. These intermediary traders are responsible for a large number of uncoordinated, small scale transactions. Traders selling in urban markets often buy higher quality rice at the industrial mills or buy larger quantities of paddy rice from intermediary traders or farmers and have it processed at the industrial mills themselves.

These different types of traders correspond to different markets. Less than half of the local commercialized rice reaches the urban and semi-urban markets. The other half is sold in rural areas further inland. While production systems are quite similar for these two markets - both originating from the same type of smallholder farmers in the SRV—the degree of processing and the marketing channels are different. Rice for urban markets is

purified and sifted into homogeneous size categories and sold to traders who buy larger volumes at the rice mills. For rice sold to rural areas, quality and sifting is less important. The marketing is less organized and consists of small volumes sold by producers or producer groups to small, informal traders.

3.3 Domestic rice channel: southern Senegal

In the southern regions of Senegal where rice production is rain-fed, yields are low, and the market chain of rice is not well developed. The system of GIEs providing access to credit (through the CNCAS bank) and inputs also exists in this region, but the volume of credit transactions is substantially smaller due to lower external input use and lower financial resources of farmers. Farmers generally use traditional rice seeds, although since 2009 improved rice seeds such as Nerica varieties are increasingly being adopted. In most of these regions women are responsible for rice cultivation and handle the primarily manual operations. The cultivation of rain-fed rice is labor intensive, which limits the cultivated area (USAID, 2009).

The processing of rice in these regions is usually done manually; small mechanical rice mills are rarely available. Households keep almost all of the rice for their own consumption. Rice production is considered a supplementary, non-commercial activity, although households might occasionally sell small quantities to local traders when they are in need of cash.

4. Constraints to smallholder market participation

In Senegal, as has been observed all over Africa, a large number of staple crop producers do not participate significantly - or at al - in the marketing of their produce. Many farmers produce mainly for subsistence purposes and only a small number often with larger farms, have a commercially oriented strategy. Of those farmers participating in commercial rice production, it is notable how little they participate in the urban markets, which contain the largest group of rice consumers.

We begin this section with a conceptual framework on the factors that determine market participation. Then we discuss two issues concerning the participation of Senegalese farmers in rice markets: (i) constraints for increased participation of farmers in commercial markets in general, and (ii) constraints for participation in the higher value rice markets in urban areas.

4.1 Conceptual framework

In many poor rural areas, many small farmers do not participate in markets at all. Several studies have looked empirically at determinants of market participation by African farmers in traditional export crops (e.g. Fafchamps and Hill, 2005; Poulton *et al.*, 2004) and high value crops (e.g. Minot and Ngigi, 2004; Humphrey *et al*. 2004; Minten *et al.*, 2009). Goetz (1992) has analysed market participation for coarse grains in Senegal.

For staple crops in general, researchers found that many producers purchase more food grains than they sell, and that only a small share of food grain growers sell anything to the market at all. Three groups of influential factors can be identified: (1) assets (2) household specific transaction costs, and (3) regional conditions (Barrett, 2008).

(1). Those households that do participate in the market typically have larger land and non-land asset holdings. Larger land (and other productive) assets are associated with higher yields and a higher marketable surplus (Barrett, 2008). The positive link between land assets and market participation is found all over Africa: for rice markets in Madagascar (Barrett and Dorosh, 1996), for wheat in Ethiopia (Bernard *et al*., 2008), and for maize in Kenya (Nyoro *et al*., 1999).

(2). Household specific transaction costs for market participation naturally lead some households to decide to participate and other households not to enter the market at all but to opt for self-sufficiency instead (De Janvry *et al*., 1991; Key *et al*., 2000). Transaction costs that are highly household specific include, among other things: experience and negotiation skills related to education level, gender or age; land assets and access to agricultural equipment; access to credit or liquidity availability.

(3). Finally, commercial households are more likely to be located in zones with better market access, better physical and institutional infrastructure and higher potential agro-ecological characteristics. Regional differences in transport costs, costs of commerce, degree of competition among traders, etc., may also contribute to variation in the level of commercially-oriented farming (Fackler and Goodwin, 2001). More remote locations may be associated with bad road accessibility, limited information on market prices and demand, and low population density, which results in limited aggregate demand and poor integration with broader markets.

Which of these factors most inhibit market participation - geographic factors or household specific transaction costs - is mainly an empirical question. Especially when surplus production volume is limited, per unit transaction costs are high and market participation may be low.

Increasing productivity through technological improvement can contribute to increased marketable volumes, thereby reducing per unit costs and making commercially oriented farming profitable. However, Barrett (2008) points out that technology and market participation influence each other; technology adoption - for example, fertilizer use or the processing of paddy into rice - will only become profitable if there is a market for absorbing the surplus created. In poorly connected markets, increased production volumes might not reach broader markets, and local market flooding will cause adverse effects through rapidly falling prices.

Farmer cooperatives offer another opportunity for reducing farmers' individual transaction costs. Through joint input purchases, common storage facilities and collective marketing, fixed production or marketing costs can be divided over larger volumes, thereby reducing per-unit transaction costs and enhancing market participation.

In the remainder of this section we concentrate on market participation in Senegal. First, we look at market participation in general versus subsistence rice production. Following that, we discuss in more detail the specific constraints to rural versus urban market access.

4.2 Constraints to market participation for Senegalese rice farmers

Regional factors clearly affect the market participation rates for rice farmers in Senegal. The degree of market participation differs largely across regions. The rain fed lowland ecosystem in southern Senegal, is a net buying region, where virtually all rice production is consumed within the region and even within households. Hence, market participation is very low. The SRV is the main area of commercial irrigated rice production with about two thirds of rice produced being marketed. These regional differences are primarily due to the different production systems. The lack of commercial orientation in the southern regions is both a reason for and a consequence of poor access to credit, irrigation, inputs and consumer markets. These limiting factors work against increasing yields and surplus production which could be marketed, although this may change with the advent of higher-yielding Nerica varieties which are being increasingly adopted in this region. On the other hand, the return on investment in improving water management and input markets is clearly higher in the SRV, which explains the government's interest in investing in rice production in the SRV.

Apart from these large regional differences between the irrigated SRV and the rainfed lowlands in the south of Senegal, there are also important differences between households situated in the same region. Although the SRV region is on average much more commercially oriented than the southern regions, not all SRV rice farmers are involved in commercial rice production and the volumes of rice sold vary greatly among farmers. In order to identify household specific determinants of market participation among SRV rice farmers, we conducted a representative household survey in the Senegal River Delta in February 2006.[4] The choice of a homogenous production area, well connected to the main road and close to Saint-Louis, largely cuts out market access as a source of variation, and makes it possible to isolate the household level determinants of smallholder market participation among SRV rice farmers.

Farmers who participate in the GIE system (including the majority of farmers in our survey area) are selling at least part of their production in order to repay the credit they obtained and so this system guarantees a certain minimum share of rice production being commercialized in the entire SRV region. But the GIEs do not collect more rice than is needed for reimbursement. Every farmer decides individually what he/she wants to do with the remainder of his/her produce.[5] Some will keep it all for consumption, some will sell immediately to traders, while others will store some of their production to sell later. In the remainder of this section we will use the terms market participation and selling farmers for those farmers who decide to sell rice individually, meaning *in addition* to the rice which is sold collectively by the farm organization to reimburse credit. To account for the rice which is not consumed by the households, one should add both types of sale.

In what follows, we first give a general description of the characteristics of rice farmers in our sample. Then we discuss how these characteristics differ between farmers who are selling rice individually, and farmers who are not selling rice (apart from the collective sales of paddy rice for credit reimbursement). Out of the 245 farmers in our sample, 182 farmers are selling rice individually.

Senegalese rice production is almost entirely through smallholder agriculture, including in the SRV region. The average amount of land assets of rice farmers in our sample is 3 ha. The average area cultivated is 2.5 ha in the rainy season (Table 2), and more than half of the farmers cultivate an area of less than 1.5 ha. The average production of rice over the whole year was about 11 tonnes. Most farmers

[4] The sample includes 245 rice producing households and is representative of the Delta region of the Senegal river (zone Gandon, Ross Béthio and Ronkh), the region of the SRV closest to Saint-Louis. More details on the survey can be found in the Annex.

[5] Only in a few exceptional cases do GIEs go beyond the repayment of loans, by collectively organizing the processing and sale of rice.

produce in the rainy season only, but 14.5 percent of rice farmers produce rice both in the rainy and the dry season (double cropping).

Table 2. Area of rice cultivation, production, and distribution of production to different destinations by farmers in the Senegal River Delta, 2005

	Rainy season (July-Jan)	Dry season (Febr-June)	Total (2005–2006)
Area (average) (ha)	2.49	1.37	
Area (median) (ha)	1.5	1	
Production (tonnes)	9.8	6.3	10.8
Double cropping (%)			14.5
% sold collectively for credit reimbursement	57.7	38.0	55.2
% consumed	21.8	30.9	22.5
% sold	16.4	24.3	17.9
% donated	4.1	6.7	4.4
	100	100	100

Source: Authors' calculation based on own survey.

Overall, more than half of the production (55.2 percent) in 2005 was sold through the farmer organizations in order to pay back the loans.[6] Apart from these sales for reimbursing credit, on average 18 percent of rice production was sold by farmers individually. Hence, total sales came to more than 70 percent. About 22.5 percent of rice production was consumed by the farming household itself.

In our sample, 75 percent of rice farmers were selling rice individually (Table 4). The large majority (62 percent) of these had first sold some rice collectively through the farmer organization to repay loans while 13 percent did not participate in the credit system of the GIEs and sold rice only on an individual basis. Most of these are larger farmers who could probably rely on other sources of financing. Of the 25 percent not selling rice individually, 3 percent sold rice through the farmer organization for loan repayment and kept the rest for subsistence. The other 22 percent of farmers produced purely for subsistence purposes and did not even sell rice collectively for credit reimbursement.

Because of the relatively high rice productivity in the Senegal River Delta and the relatively good road connection to the rest of the country, it is not surprising that the share of farmers selling rice individually (75 percent) in our sample is high compared to the rest of the country and compared to percentages of staple food sellers reported in other studies.[7] Note that this is considerably higher than the one third of rice production sold for credit reimbursement that was estimated by USAID (2009), which might be related to our survey data corresponding to a year of low production.

Yet even within this commercially-oriented region, nearly one quarter of farmers are producing for subsistence. And also among farmers participating in the marketing of rice, there are large differences in the volumes of rice sold.

[6] Note that this is considerably higher than the one third of rice production sold for credit reimbursement that was estimated by USAID (2009), which might be related to our survey data corresponding to a year of low production.
[7] In East and South Africa, percentages of sellers among staple food producers vary between 10 and 40 percent (Barrett, 2008).

Table 3 illustrates some general characteristics of farmers selling (commercially oriented farmers) and farmers not selling rice. Sellers tend to have larger areas of cultivation and higher output and yields. There seems to be no difference in age or education level. Members of farmer organizations are more likely to be rice sellers, as are double cropping farmers. Commercially oriented farmers have a higher income and more land and non-land assets. A larger population corresponds to a higher percentage of sellers in the village. The insignificant difference in distances to a paved road and to Saint-Louis confirms our initial hypothesis that market access is fairly homogenous among farmers in the Senegal River Delta.

Table 3. Household assets and characteristics of farmers selling and farmers not selling rice

	Farmers not selling rice	Farmers selling rice	t-test
Area of rice cultivation (ha)[a]	1.40	3.53	***
Total rice production (kg)	4,538	12,920	***
Yield (tonnes/ha)	3.43	4.78	***
Double cropping (% of farmers)	6.3%	29.7%	***
Age	55.7	56.1	
Elementary education	7.9%	9.3%	
Female household head	0%	5.5%	***
Union member	38.1%	51.1%	**
Total land owned (ha)	1.94	3.32	***
Non-land assets	207.1	1125.6	**
Total income (FCFA)	719,723	1,233,208	***
Per capita income (FCFA)	136,487	169,877	*
Agricultural income (FCFA)	397,027	727,632	***
Village population	977.5	1287.4	***
Distance to Saint Louis (km)	59.3	57.2	
Distance to paved road (km)	9.6	7.9	
Number of observations (n=245)	63	182	
	(25.7%)	(74.3%)	

Source: Authors' calculations based on own survey.
Notes: Fixed exchange rate: euro1 = 655.957 FCFA. Significant differences (two-sided t-test) are indicated by *: p=0.10, **: p=0.05, ***: p=0.01.

[a] Area, production and yield refer to total area and production, i.e. the sum of area and production of wet and dry season.

These descriptive statistics indicate that in areas with much commercial activity, household assets are an important determinant of market participation. This is in line with other studies showing that privately held assets impose important constraints to market participation (Boughton *et al*. 2006; Cadot *et al*. 2006; Minten and Barrett, 2006). We do find that a large village - reflecting larger local demand - increases the likelihood of selling rice. While distances to the road and to Saint-Louis are not found to be important within our study area, infrastructural constraints at the regional level are obviously very important in explaining major differences between the two main rice producing regions (Senegal River Valley and southern rainfed low-lands).

The majority of farmers in the Senegal River Delta (74.3 percent) participate in individual sales of rice, yet volumes traded are very unequally distributed. Only 2 percent of farmers account for 25 percent of total rice sales; 7 percent of farmers sell 50 percent of the total volume sold, and 26 percent of farmers account for 75 percent of rice sold. We refer to those in that 26 percent as large sellers.

Differences in household characteristics and assets between sellers and non-sellers are also found when comparing large sellers and small sellers.

Table 4. Characteristics of large and small individual rice sellers

	Small sellers (accounting for 25% of total sales)	Large sellers (accounting for 75% of total sales)	Total (2005–2006)
Area rice cultivation (ha)	1.84	5.98	
Yield in rainy season (tonnes/ha)	4.14	5.08	
Yield in dry season (tonnes/ha)	4.82	5.30	10.8
Double cropping (% of farmers)	26.3	40.0	14.5
% of total farm production sold	14.2	28.4	55.2
Average volume sold (kg)	952	8,840	22.5
			17.9
Average price (FCFA/kg)	99.4	101.2	4.4
% of farmers selling to intermediary traders	86.5	80.9	100
% of farmers selling to traders in urban market	2	6	
Number of observations (n=182)	137	45	

Source: Authors' calculations based on own survey.

Table 4 also indicates the importance of farmer organizations in the commercial orientation of farmers. Farmer organizations usually only oversee the demand for credit and the distribution of inputs and irrigation water. Without personal funds or individual access to credit, it is necessary to be part of a farmer organization in order to be able to cultivate a significant area. Through facilitating access to credit and inputs, and thereby increasing production, union membership can enhance individual market participation, even when the farmer organizations usually do not arrange for the commercialization of surplus production. The main reason for the limited commercial activity of farmer organizations is the heterogeneity of producers. While some farmers are in urgent need of cash at the end of the season

and prefer to sell the paddy rice immediately after (or even before) harvesting, others have the option to postpone sales and transform the paddy into sorted rice themselves and store it for a higher price season. The credit provided to farmer organizations can only be used for the purchase of seeds and inputs. Farmer organizations do not negotiate marketing credit which would allow them to collect, transform and store all surplus rice production and advance some of the total sales revenue to farmers. Moreover, farmer organizations often lack the management and marketing skills to perform these tasks.

PINORD (*Platforme d'Appui aux Initiatives du Nord*), an Oxfam-funded platform of farmer organizations, is trying to improve the commercial activity of farmer organizations by providing credit and monitoring quality of a newly created rice brand, Rival®. However, while PINORD's model for the increased commercialization of quality SRV rice may be a good preliminary step toward competitiveness, the operational scale is currently too small to have a significant impact on the market. PINORD marketed 500 tonnes of milled Rival® rice, produced by 10 rural micro-enterprises (RMEs)[8] in 2007, 1800 tonnes by 108 RMEs in 2008, 2 600 tonnes by 150 RMEs in 2009, and 6 200 tonnes by 350 RMEs in 2010. However, the product was only available as far as the milling factories in the Senegal River Delta (50 km from Saint-Louis) and did not reach the urban market of Saint-Louis. In 2011–2012, no Rival® was commercialized due to discontinued external funding (Demont *et al*., forthcoming).

4.3 Constraints on access to local and urban markets

Not all farmers who produce a marketable surplus of rice and are willing to sell it have access to the same market channels. In the rain-fed zones there is hardly any commercial activity at all, even locally. In the SRV, local rice markets are better developed - more so in the Delta region than further inland - although transaction costs are still considerable and markets are highly fragmented. The organization of input and credit provision by farmer organizations results in a minimum volume of rice being sold in order to repay loans. Usually farmer organizations sell to local intermediary traders (*banabanas*) who sell the rice on local or regional markets further inland and (less frequently) to traders in urban markets. Sales made by farmers individually are often smaller, more irregular transactions. Most farmers sell a part of their production to *bana-banas* after harvesting and store another part for consumption or for sales at a later time. Farmers and farmer organizations usually do not have long term relationships or agreements with these traders, and transactions are ad hoc. These irregular, small sales keep transaction costs rather high and reduce market efficiency.

Transactions with traders who are active in urban markets concern larger volumes but are less frequent. Some *bana-banas* have connections with traders in urban markets, but these transactions are also fragmented and irregular. Some retailers or larger urban traders buy directly from producers, but the total volume of SRV rice reaching urban markets remains small.

The data from our survey in the Senegal River Delta confirm this picture. In our sample, 85 percent of rice farmers selling individually market their produce through intermediary traders *(bana-banas)* and only 8 to 9 percent sell to traders in weekly markets (Table 5). Only 3 percent (8 percent in the dry season) sell directly to traders in urban markets, although the price those traders pay is 15 to 20 percent higher.[9]

[8] These rural micro-enterprises refer to various actors in rice production, such as farmers, service providers and input suppliers.

[9] Note that our sample concerns the zone of the SRV that is best connected to urban markets and where farmers' commercial orientation is higher than in other parts of the SRV region. Hence, overall percentages of farmers selling their produce to urban markets will be even lower.

Table 5. Share of farmers and prices by type of trader for the rice sold by farmers individually

	Rainy season (July-January)		Total (2005–2006)	
	% rice farmers selling to	average price (FCFA/kg)	% rice farmers selling to	average price
Intermediary traders	85.1	103.5	80.3	98.6
Traders in weekly markets	8.5	91.3	9.2	91.4
Traders in urban markets	2.8	123.8	7.9	111.7
Sold directly on the market	2.8	95.5	-	-

Source: Authors' calculations based on own survey.

There are two reasons for the low penetration of SRV rice in urban markets. First of all, as documented earlier, urban consumers prefer broken rice, sorted into categories of homogenous size and they value the cleanness and visual presentation of rice (Fall *et al*., 2007; Demont *et al*., forthcoming). In contrast, most of the local paddy rice is only transformed into milled rice at a small informal mill, but not cleaned and sorted (which rural women usually do at home) and it involves mainly intermediary and whole grain rice. Although studies show that urban consumers are willing to pay a higher price for good quality local rice, consumers in Dakar generally believe that local rice is of inferior quality (Fall *et al*., 2007). There clearly is a mismatch between the product demanded by the majority of Senegalese consumers and the product characteristics of domestic rice that is supplied to them.

Second, transaction costs related to getting local supply to urban consumers are very high. Road infrastructure and transportation should not be major constraints. A national road runs parallel to the Senegal River, where irrigated rice production is concentrated. In fact, limited information and unreliable quality and quantity are the main problems. Traders in Dakar have little information on the marketable volumes of local rice, its quality and prices. The most important constraint is probably the fact that transactions in local markets pass through a high number of small intermediary traders and there are very few actors in the chain who collect, store and sell rice in large volumes. Neither farmer organizations, rice millers nor local traders succeed in concentrating transactions into larger volumes.

As we have seen, farmer organizations have not been successful in collectively processing or storing rice in order to market better quality rice in larger quantities. The diversity of farmers makes it difficult to develop common marketing strategies.

Industrial rice mills could potentially serve as places to store larger volumes of rice which could then be sold in large quantities to traders further down the chain. Currently both small village level mills and industrial rice mills act only as service providers. Industrial rice millers do not have sufficient working capital to purchase paddy rice and they have very limited access to commercialization credit. This is in part because local branches of the national bank for agriculture are not allowed to provide credit above a certain amount without agreement from national headquarters. An earlier attempt to provide government supported loans to millers failed because millers could not sell the rice within the period of credit reimbursement and trust has not been restored since that experience.

Local traders do not have the means to buy larger quantities. The small informal traders buy very small quantities and focus on trading low quality, unsorted rice to the rural markets. The lack of coordination between the different actors, combined with the small transaction volumes, significantly reduces

marketing margins for local rice, which reduces their incentive to invest in facilitating the flow of SRV rice to urban consumers. However, the recent price volatility and concomitant business risk since the food crisis in 2008 have led some Senegalese importers to begin gravitating toward SRV rice (Demont and Rizzotto, 2012).

5. Implications, policy recommendations and perspectives

Senegal is extremely dependent on imports of rice, its main staple crop. National programs to promote self-sufficiency, such as GOANA, are investing in the expansion of irrigated plots and technology improvement in order to increase domestic rice production and reduce import dependency.

However, the issue is not merely how to increase production, but how to increase the market participation of smallholders and especially how to integrate rice produced in the SRV into urban markets. Our main policy recommendations start with the recognition of this mismatch between the characteristics of local rice and the preferences of urban consumers. Below, we offer recommendations to address the main constraints related to the development of rice value chains in Senegal.

5.1 Focus on demand and private sector involvement

The current set of strategies put forward by the Senegalese government in the GOANA program emphasizes production and fails to include significant efforts to involve private sector actors. The government's focus is on production and farmer organizations, with very little attention to creating an environment to assist private actors in post-harvest activities and marketing.

Improved commercialization of rice will require establishing conditions that are more favorable to the private sector. A stable investment climate, transparent policies, large infrastructure investments such as irrigation, and guaranteed access to resources such as land and water, are necessary to attract private investment and encourage risk-averse producers to engage in commercial rice production. More transparent criteria for land concession could motivate more commercially-oriented farmers to invest in land preparation and irrigation infrastructure themselves.

The most successful new development models start from the perspective of demand rather than supply.[10] Sustainable incentives for investing in increased supply will exist only if there is enough demand to absorb the product and if the product characteristics fit the demand preferences (Demont and Rizzotto, 2012).

Given the large demand for rice in urban markets, there should be considerable opportunity for the increased development of the rice supply chain in Senegal. The potential market is much larger than the current level of domestic production and an increased supply of rice should therefore easily be absorbed by the large number of consumers in urban areas.

[10] See, for example, the successful approach of the European Bank for Reconstruction and Development (EBRD) in its lending operations in Eastern Europe and the former Soviet Union.

However, there are two important problems: (i) the quality of locally-produced rice currently does not correspond to what consumers want to buy; and (ii) transaction costs to bring locally-produced rice to the urban markets are high, which reduces marketing margins and makes it difficult for domestic rice to compete with the price of imports. So the main challenges are: (i) to upgrade the quality of domestic rice and (ii) to organize production, processing and marketing of domestic rice more efficiently so as to reduce transaction costs.

5.2 Quality upgrading

The first challenge is how to produce the quality and type of rice that urban consumers want to buy. Problems related to improving quality seem not to be insurmountable, as they are not inherent to the country or the production system as such. Rather the main problems are due to poor processing, which does not conform to consumer preferences. Currently the largest share of local production passes through small informal mills at the village level, which are unable to sort the rice mechanically or to remove foreign matter. Policies should stimulate private investments in improved processing and sorting of rice. Another way to improve quality is to speed up the drying process of paddy rice. Due to poor storage facilities, rice often is not dried quickly enough, which reduces quality or may even cause the rice to rot.

Recent evidence from experimental auctions in the urban markets of Dakar and Saint Louis confirms that there is a willingness among urban consumers to pay a price premium for local high-quality rice (Demont *et al*., 2013; forthcoming). Under experimental conditions, the majority of Senegalese consumers were willing to pay an 18 percent price premium for imported Thai 100 percent broken rice relative to conventional, ungraded SRV rice. However, they were willing to pay an even larger price premium, 35 percent, to obtain enhanced-quality SRV broken rice. Conventional, ungraded SRV rice is a mix of varieties, has a mediocre grain quality, and is commonly available on the market. Imported Thai 100 percent broken rice has a grain quality somewhere between the conventional and the enhanced-quality SRV broken rice and contains some impurities. Enhanced quality SRV broken rice is purified and homogenized through one or two sifting operations. On top of the price premium of 35 percent for enhanced quality SRV broken rice, the majority of Senegalese consumers were willing to add another 6 percent for a branded rice product, paying an overall price premium of 41 percent for PINORD's Rival® (see Box 1) relative to conventional SRV rice. These findings suggest that Senegalese consumers are willing to pay for intrinsic food quality attributes and that SRV rice is able to compete against imported rice if post-harvest quality is tailored to consumer preferences.[11]

But also breeding currently plays a role in tailoring quality to urban consumer preferences. In 2011, three fragrant rice varieties bred by AfricaRice (Sahel 177, 328 and 329) have been introduced in the SRV. Given that an important market segment of urban consumers (particularly in Dakar) prefers imported fragrant rice, this introduction opens the door for the development of domestic value chains of fragrant rice and further replacing imports with domestic rice.

[11] Enhancing quality in the context of a food insecure country may seem counterintuitive at first, but is consistent with similar findings in Asia revealing that even the very poor have more income elastic demand for food quality than for food quantity (Shah, 1983).

Box 1. Recent initiatives for quality upgrading of SRV rice

The quality upgrading of rice might create opportunities for the development of a certain degree of coordination over the value chain. Recently, SRV producers have combined their efforts to supply a new enhanced-quality SRV broken-rice brand *Rival*® (*Riz de la Vallée*). Governance of quality (processing, cleaning and packaging) and provision of micro-financing for rural micro-enterprises in the rice sector are conducted by the Oxfam-funded platform PINORD. Since its inception, PINORD recognized that absence of marketing for local rice was a major obstacle to the mobilization of quality SRV rice onto the market. PINORD's promotion strategy is fourfold: improving packaging, improving transport, increasing market share and points of sale in urban markets (especially in Dakar), and multimedia publicity surrounding the label *Rival*® (PINORD, 2007).

Although this initiative still faces several obstacles, and the establishment of strong relations with traders is still a challenge that must be addressed, it's clear that it is possible to produce domestic rice that is perfectly acceptable to urban consumers. However, as hypothesized earlier, successful governance of value chains may have to come from downstream stakeholders closer to the demand side. Recent developments confirm this hypothesis. On 25 November 2010, 14 Senegalese rice importers officially launched a joint venture with producers and processors under the name SPCRS (*Société de Promotion et de Commercialisation du Riz Sénégalais*). The SPCRS aims to buy the entire SRV paddy rice production, mill it and market it to Senegalese consumers by governing quality along the chain through quality contracts with milling factories and farmers (Mohapatra, 2011). Two other smaller scale value chain initiatives have emerged, targeting different consumer segments in important urban end markets. Since 2010 importer Marieme Diouck, in partnership with USAID, has contracted with SRV farmers to market high quality SRV rice – branded Bourou thieb yi (the king of rices) – on the Dakar market, and the Belgian investor Durabilis is currently contracting with SRV farmers and millers to market medium quality SRV rice, branded *Terral*, through its local subsidiary, Secosen. These recent developments clearly illustrate the interest and potential of the private sector to play a lead role in the development of rice value chains in Senegal.

5.3 Vertical linkages

Industrial or semi-industrial processors of rice can play an important role in improved storing and processing of rice. But industrial rice mills can only operate efficiently at a large scale and therefore a significant part of rice production needs to pass through the industrial mills.

While there is probably insufficient value in a staple food market such as the current rice market, and too much competition from local traders and alternative uses to make extensive vertical coordination possible, there should be some room for supply chain-based financial innovations in the chain (see Box 2). Supply chain-based financial instruments, such as reverse factoring – which transfer the credit risk of small suppliers to their more credit worthy customers – might offer a solution. A focus on lending and co-financing of rice processors and traders might stimulate vertical linkages.

Box 2. Can the supply chain governance of high-value agricultural products be used as a model for the development of supply chains of staple food?

In a context of imperfect markets such as in Senegal, where smallholder producers have limited or no access to inputs and credit, rice traders with better access to credit could solve this constraint by providing the farmer with a contract: the buyer would provide the required inputs (e.g. certified seed of a particular rice variety) and in turn the farmer would sell a specified quantity of the product to the trader at an agreed price. There are two different models possible: either the trader purchases rice already milled or buys paddy rice and processes it into milled rice using a miller as service provider. Because establishment of the contract would now allow the farmer to produce more and/or to produce higher quality, the contract creates a surplus. This type of chain governance model has been very successful in high value chains, such as the export of fresh fruit and vegetables in Senegal. The development and organization of these supply chains are described in detail in Chapter 9 of this volume. The question is whether this chain governance model could also be successful for the Senegalese rice sector. A number of constraints present in the rice sector make it less likely for these governance structures to be established.

When contract enforcement is costly, there are risks of contract breach. The farmer may decide to divert the inputs to other uses or he may sell to another buyer at a higher price (since this buyer does not need to recover the credit that was provided). On the other hand, the buyer can breach the contract by paying a lower price than was agreed on. If the contract creates enough surplus, compared to the situation without a contract, then none of the parties will be better off by breaching it and a credible commitment can be established. Only if enough value can be created in the chain will it be possible to develop interlinked contracts between traders or millers and farmers.

Staple crops such as rice are characterized by low value and the potential for quality upgrading is limited. In addition, the low perishability of rice makes it possible for a farmer to store his product, anticipating higher prices in the future, rather than respecting the contract. The large number of small intermediary traders gives farmers multiple selling opportunities and reduces potential reputation costs of contract breach. These factors make it less likely for chain governance to arise spontaneously. However, the chance of successful vertical coordination is likely to increase with enhanced quality and demand.

5.4 Reducing transaction costs

When investments in quality upgrading and vertical linkages have been stimulated, it is important to focus on improving the supply side of the market by reducing transaction costs. Aggregation points need to be established, where rice can be collected such that transaction volumes in the chain are sufficiently large and per-unit transaction costs can be reduced. Several approaches could be taken to address this need. Investment in physical market infrastructure could lead to the emergence of larger traders. Aggregation points could be established, either at the level of producer organizations (which would require better coordination) or at the level of industrial mills. This would allow traders to transact larger volumes, thereby reducing trading costs. Investment in transport infrastructure could reduce the cost for small traders to bring rice to the mills, thereby increasing the volumes of adequately processed rice.

5.5 Promotion of domestic rice

Once a sufficient supply of clean, quality rice at a competitive price is ensured, investment in promoting Senegalese rice would be one possible strategy to stimulate the demand for local rice (see the case of *Rival*® above). However, local production must offer the characteristics demanded by consumers and the major transaction costs must be addressed. Data from recent experimental auctions point to an increased likelihood of consumers purchasing quality SRV rice when they are aware of it (Demont *et al*., forthcoming). The most promising channels for promotion campaigns are television and radio (Demont and Rizzotto, 2012), but marketing strategies based on word-of-mouth, i.e. buzz and viral processes that exploit influential existing social networks (female networks, tontines, trader associations, religious and social networks, etc.), can also have a large impact (Demont *et al*., 2013).

5.6 Increasing productivity in southern rain-fed rice production areas

A different set of policy recommendations is needed for the very different production system in southern Senegal. In the rain-fed rice production areas, the first concern is to increase productivity. In contrast to rice farmers in the SRV regions, farmers in the southern regions have very limited access to input and credit. If better seeds and appropriate fertilizer can be provided at an acceptable price, farmers may be willing to invest more in rice production than they do now. Increasing the efficiency of private suppliers who supply inputs for other crops could improve the accessibility and lower the price of inputs. Rain-fed rice production is labour-intensive so labour availability and competition for labour with other crops may also pose constraints to increasing production.

Finally, improving the ability to cope with risk could stimulate farmers to invest in strategies to increase productivity. Risk-averse households are reluctant to make investments such as purchasing inputs. Investment in inputs and techniques for increasing productivity requires a willingness to cope with risks. Building up savings and insurance mechanisms can help to stimulate more risky investments, including productivity enhancing strategies for rain-fed rice production.

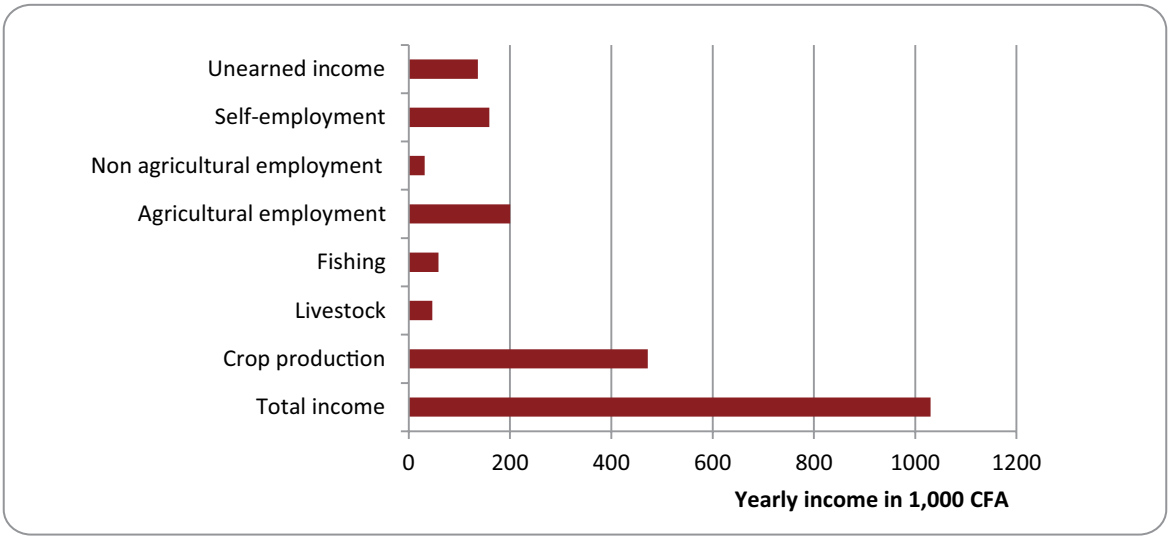
Since the introduction of improved rice varieties, such as Nerica, productivity is dramatically increasing in the Casamance region to the extent that rice production systems are progressively generating marketable surpluses. Moreover, consumers already prefer local rice in that region. Recent experimental auctions carried out by AfricaRice and USAID have shown that Nerica not only boosts productivity, but is also preferred by consumers in urban markets (e.g. Kolda) relative to imported rice. The more these production systems evolve from purely subsistence to surplus-based, the more attention will need to be given to value chain upgrading.

6. Annex: Description of the survey and interviews organized in the Senegal River Delta in 2006

From February to April 2006, a representative household survey was organized in the delta area of the SRV region. The survey covers 400 households living in the rural communities of Gandon, Ross Béthio and Ronkh. The sample includes 245 rice- producing households. Survey data include demographic characteristics, land and non-land asset holdings, agricultural production and inputs, off-farm employment, non-labor income, credit and savings.

The average household income in the region is around 1 million CFA, or 179 000 CFA per capita. The poverty rate in the area is 56 percent, which is comparable to the national average. Households in the region have diversified income portfolios. More than half of the total household income is derived from agriculture, mainly from crop production. Income from fishing and livestock is limited. Other main income sources are agricultural employment, self-employment and unearned income (Figure 3).

Figure 3. Income sources for households in the survey region (authors' calculations)



In addition, stakeholders from the different levels of farmer organizations, traders, importers, government representatives at SAED, and researchers at the Africa Rice Center in Saint-Louis were interviewed.

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