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Generating employment and increasing income in agricultural value chains and thereby fostering food security: Case studies of rice and cotton in Benin and Senegal

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Abstract

In this paper, we use a case study approach to investigate the patterns of employment and income generation in cotton and rice value chains in Senegal and Benin. The purpose of the paper is to provide a comprehensive description of both value chains in both countries, emphasizing export potential and innovation entry points with the goal of assessing capacity to generate income, create jobs, and bring about food security. To this end, we have combined quantitative and qualitative data to identify direct and indirect value chains' effects on employment and income, paying special attention to vulnerable groups such as youth, women, and informal employees. Surveys data as well as Social Accounting Matrix, have been used to assess the effects of these value chains on employment and income. Our results show strong relationships between value chains and jobs and income patterns.

Keywords: value chains, social accounting matrix, agriculture in Senegal and Benin, rural employment and underemployment, rice and cotton, output and employment multiplier

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1 Introduction

Africa's spare capacity in agriculture is a widely discussed topic. Most of the world's uncultivated arable lands are in Africa, yet African countries still rely on imports to feed their people. This provides a major argument for investing in Africa's agricultural value chains. In an effort to encourage countries to improve food security, reduce poverty, promote economic growth, and create wealth from agriculture, the African Union declared 2014 the year of agriculture and food security in Africa (Schaffnit-Chatterjee, 2014).

Benin and Senegal illustrate the twofold paradox of a country having significant agricultural resources and still relying on food imports to feed its population. In Senegal, agriculture employs nearly 60% of the working age population and receives around 10% of public investment (PTIP, 2014)[1] on top of private investment, while contributing only 7.86 % to the national GDP (DPEE, 2013). In its new economic policy, the Senegalese government considers agriculture to be the engine of sustainable growth which is meant to generate sustainable and attractive employment. The distribution of the population between rural and urban areas widely justifies this orientation. According to the 2013 census, 54.8% of the population resides in rural areas and is thus largely employed in the agricultural sector. However, agricultural employment remains unattractive due to low wages. In order to improve its productivity and to respond to the challenges of poverty and food security, the Senegalese government has implemented a policy of diversification within the framework of the Agro-Sylvo-Pastoral Orientation Law (LOASP). This new policy places greater emphasis on the agricultural value chain and agricultural clusters approaches. Senegalese agriculture remains largely dominated by family, rainfed, and extensive agriculture, with very little capacity for income generation. In addition, purchases of harvesting equipment, fertilizers, and selected seeds from these households remain at an extremely low level, which ensures neither the renewal of farming equipment nor the maintenance of soil fertility and seed capital (Faye et al.). One of the main characteristics of Senegalese agriculture is that it is mainly rainfed and seasonal, as evidenced by the sharp fluctuations in production. In most cases, agricultural producers are smallholders who cultivate land on traditional land tenure and follow traditional cropping patterns. Agricultural production remains strongly dominated by cereal crops (millet, sorghum, maize and rice), cash crops (groundnut and cotton) and other food crops (cassava and cowpea). The groundnut sector, which is the country's primary industrial crop and the main source of income for most farmers, is experiencing a sharp decline in performance in recent years. Other industrial crops such as cotton and tomatoes, however, have made relatively good progress.

Given the high dependence of the production systems of Senegalese agriculture on climatic variations, water control is of paramount importance for national authorities. The irrigable

[1] Public Investment Triennial Program (PTIP) 2015 - 2017, published in 2014 by the Ministry of the Economy, Finance and Planning

potential is enormous, around 397,100 hectares, but only 106,600 of the areas are managed, including 76,000 hectares in the Senegal river valley (Diallo et al., 2004). Land degradation and lack of human and financial resources are other difficulties faced by the agricultural sector in Senegal. Some consider the difficulty of finding relevant agricultural workforce paradoxical given the youth unemployment and underemployment rate. This raises questions about the policy strategy of keeping young people in the agricultural sector and about the attractiveness of agriculture to young people.

Despite various agricultural policies implemented since its independence, Benin's agricultural sector is still traditional. The government has initiated various agricultural policies to boost agricultural sector development since independence. Recently, the *Plan Stratégique de Relance du Secteur Agricole* (PSRSA, Strategic Plan of Boosting the Agricultural Sector) has been designed for the period 2010-2015 to improve the growth of the agricultural sector. It is worth noting that agriculture is expected to play a key role in boosting the economy according the 'Vision Benin Alafia 2025', which is a long-term vision of development of the country. The agricultural policies initiated are also in line with those of the regional economic communities to which the country has committed itself (e.g., the Politique Agricole Commune (Common Agricultural Policy) of the West African Economic and Monetary Union (WAEMU), the West African Common Agricultural Policy (ECOWAP), and the Comprehensive Africa Agriculture Development Programme (CAADP)).

In Benin, similarly to Senegal, poverty is high in rural areas (MAEP, 2011; République du Bénin, 2014). In addition, the population in rural areas depends mostly on agriculture for its livelihood. The agricultural sector is dominated by smallholder farms, which are highly sensitive to climate change and variability due to the rain-fed nature of the agriculture. Generally, the application of fertilizers and pesticides is not widespread in the country, except sometimes in the case of cotton. In 1992, 408,020 farms were counted in the country; 370,338 were headed by men and 37,682 by women (MAEP, 2011). In 2008, the number of farms increased to 550,000. On average, the size of land plots cultivated by small (less than 7-person) households is only 1.7 ha. Moreover, about 34% of the farms have less than 1 ha. In the south, only 5% of the farms have more than 5 ha, compared to 20% in the north. Despite the preponderance of farm-household type operations, modern agricultural enterprises are also found in the sector (MAEP, 2011). However, these initiatives are not yet widespread for many reasons, including soil degradation and low availability of chemical fertilizers for crops other than cotton.

In spite of the favorable climate and diversity of soil types, Benin continues importing many products from abroad, such as horticulture products from Burkina Faso and Nigeria and rice from Asian countries. It is worth noting that the share of national budget allocated to agriculture is around 5%, below the 10% recommended within the CAADP framework (MAEP, 2010). Nevertheless, from 2006 to 2012, the share of public expenditures on agriculture in the

national budget exceeded 5% and amounted to 11.24% in 2008 (Table 1).[2] Benin has many potentials for growth that have not yet been fully taken advantage of. Unlike in Senegal, adoption of a value chain approach to agriculture is still missing in Benin, despite its well-documented potential benefits to the sector.

Table 1: Evolution of public expenditures in the agricultural sector in 2006-2012 in Benin

Years	2006	2007	2008	2009	2010	2011	2012
Total agricultural budget (millions of CFA F)	55,1	67,2	110,4	88,8	76	78,7	85,6
Share of national budget allocated to agriculture (%)	9.5	8.7	11.2	10.1	8.7	8.8	9.5

Source: MAEP and MEF (2013)

In this study, two value chains are analyzed and compared: rice and cotton which play an important role in both the Beninese and Senegalese economies. While the rice sector is dominant in Senegal, it is relatively small in Benin. In contrast, cotton is the backbone of the economy in Benin but is a negligible part of the economy in Senegal. Rice benefits from a state program aimed at achieving self-sufficiency to reduce imports in Senegal. Cotton, on the other hand, is export-oriented and has always been considered as the main cash crops in Benin. These two value chains constitute a significant part of the agricultural labor force and contribute strongly to the growth of rural income, in both countries. The reminder of the paper is organized as follows: section 2 analyzes the main patterns of rural work force and employment emphasizing on the rice and cotton value chains, in both countries. Section 3 reviews the main features and the functioning of both value chains in the two countries. Section 4 analyzes the relationships between value chains and jobs, using survey data and SAM. The conclusion and policy implications follow in section 5.

[2] These expenditures account for direct financing to agricultural production (crop production, livestock, and fisheries), roads in rural areas, forestry, electricity and drinking water supply systems in rural areas, agricultural credit, and agricultural subsidies (MAEP and MEF, 2013). Therefore, they do not account only for agricultural investments.

2 Jobs and income in Rural Senegal and Benin

In West Africa, agriculture is completely structured by the informal sector. In their study of Benin, Burkina Faso, and Senegal, Benjamin and Mbaye (2012) conclude that the agricultural sector is the sector most affected by informality. Main characteristics of an informal economy include precariousness of existing jobs and low earnings. Collective agreements on the agricultural sector correspond to the lowest levels of compensation and protection for employees. For example, in Senegal, the minimum guaranteed agricultural wage (SMAG) is set at CFAF 182.95 (around 36 cents) per hour by Decree 96-154 of February 19, 1996, whereas it exceeds twice that amount for trades governed by other collective agreements. This SMAG has not changed in 20 years. Moreover, salaried employment accounts for a very small share of employment in rural areas. Self-employment and domestic employment are also informal and correspond to precarious levels of remuneration and protection.

One of the peculiarities of the agricultural sector in West Africa is its heterogeneity. Specifically, given the strategic importance attached to the production of rice and cotton in Benin and Senegal, sophisticated peasant organizations govern the two value chains, whereas more traditional agricultural practices and levels of organization are observed for other agricultural products. These forms of producer organization, which are often an integral part of the state's support mechanisms for rice and cotton producers, are not necessarily found in the production zones of other agricultural products. The purpose of this section is to show how the organizational patterns of rice and cotton production zones affect employment and income formation dynamics.

2.1 Jobs and income in Senegalese rural areas

Almost half of the Senegalese population is under 20 years of age. Each year, the working-age population increases by about 250,000 while the formal economy creates only about 50,000 jobs (Golub and Mbaye, 2015). This creates high tensions in the labor market where the sum of the unemployment rate and the underemployment rate is not very far from 50% of the total labor force. The latest census of population and housing in Senegal shows that the working age population, between 15 and 64 years old, is 7.3 million, while the active population is estimated at 3.1 million, about 32% of the total population. The working population is divided between rural areas (59%) and urban areas (41%) and the employment characteristics are very different between these two areas. According to the household survey (République du Sénégal, 2001), the main characteristics of rural employment in Senegal are as follows:

- The number of years at work is higher than in cities. Young people start working before the age of 15 (nearly one child in two) and older workers work beyond the age of 64 (almost nine out of 10 seniors).

- Employment is concentrated around the primary sector in small-scale farms. Approximately 8 out of 10 workers have farming, livestock, or logging as their main source of income. The farms in which the labor force is employed are of the family or individual type, i.e. small enterprises.
- Conditions of employment are extremely precarious. While employment rates are on average higher in the countryside, the majority of workers are seasonal workers (6 out of 10) and only a quarter consider themselves to have permanent full-time work. Labor informality is almost universal, as virtually all workers do not benefit from formal social security coverage.
- Finally, the level of education of those who work is very low. More than seven people (over the age of 15) out of 10 did not attend school.

In rural areas, the labor market contains essentially two groups of activities: agricultural activities and non-agricultural activities. In both cases, the supply of labor depends on several factors, including demography, social norms, access to land, education, and so on. Demand is expressed by both agricultural and non-agricultural enterprises and depends on the production system, investment volumes, access to markets, etc.

2.1.1 Women and youth

Official unemployment is less common in rural areas than in urban areas. In rural areas, the main problem related to the employment of young people and women is underemployment and inactivity. The proportion of inactive youth consists of people aged 15 to 34 who are neither at work nor in school. Almost half of the young and inactive women are employed in family farming and payment is usually made in-kind (main food and shelter). They are often referred to as live-in caregivers. Alongside the inactive young people and family helpers are the young heads of agricultural production units. They represent a small proportion of the workforce and are predominantly male, with women accounting for only 29% of agricultural production unit heads. Moreover, 88% of young people do not have any regular source of income. Women are also affected by this constraint, especially the younger ones. This is evidence that young people and women have limited access to land and capital. Similarly, youth and women are poorly represented in producer organizations. Women in particular rarely lead individually. They participate either through women's groups or through their head of household. The CNCR has created a youth college in response to some of these concerns. Suggestions have been made to the state to reserve quotas for women and young people in the event of new land development schemes (Hathie et al., 2015).

Access to the means of production is limited among young rural dwellers, especially land and equipment. In addition, the financial capacity of young people is low, so they often start with activities that require low initial investments and quick returns (such as horticulture, and short-cycle farming). The lack of financial backing associated with lack of experience makes

young people more vulnerable to uncertainties such as market fluctuations, climate shocks, and theft (Grain de sel, 2015).

The educational level of the rural labor force is relatively low, with an overwhelming proportion of uneducated people. The majority of the educated have not passed the primary cycle. However, Koranic instruction has a significant presence. This low level of educational attainment affects mostly women; more than half of rural women have never attended school.

2.1.2 The case of the River Senegal Delta

Rural household surveys (EJAMS) conducted by IPAR showed that 91% of rural households are employed in the agricultural sector. Other households (9%) are engaged exclusively in non-farm activities. This distribution is very heterogeneous across production zones. For example, in the delta, which is the main rice production area, producing year-round is possible for 52% of exclusively agricultural households, 4% of non-agricultural households, and 33% of mixed households. This can be compared to other areas such as the Groundnut Basin, where 25% are exclusively agricultural households, 7% are non-agricultural households, and 68% are mixed households.

2.1.3 Cotton in Senegal

The cultivation of cotton creates many direct jobs. There are an estimated 71,000 cotton producers, and each of them support up to 5-7 families. Additionally, the region contains all the production and ginning activities of the country. Ginning activity in the region employs 81% of the permanent and seasonal labor force. The downstream industrial companies (spinning, weaving, and garment) reside in the major cities of Dakar, Thiès, and Kaolack.

2.2 Patterns of jobs in rural Benin, with a special focus on rice and cotton value chains

In Benin, the agricultural sector provides employment to more than 70% of the active population (République du Benin, 2014). The evolution of employment in Benin for the years 2007, 2010, and 2011 is presented in Table 2.[3] The share of people who have a job was 77.4%, 75.3%, and 71% in 2007, 2010, and 2011, respectively. This shows a slight decline in employment in the country from 2007 to 2011. There is a clear gender disparity in terms of employment in the country; men are employed more than women are. For instance, in 2011 73% of men were occupied, compared to 69.2% of women. A slight decline in employment can also be noted from 2007 to 2011 for both men and women. Turning to the distribution of employment with respect to residency, rural residents are more employed than their urban counterparts, except for in 2010. In rural areas, people are mostly engaged in agriculture, and

[3]All data from INSAE used in this section are available at http://insae-bj.org/emploi-chomage.html.

some off-farm activities complement their income from agriculture. It is worth noting that this employment level encompasses informal employment and under-employment. There are disparities between departments (regions), although the employment rate is high for all of them. As for the distribution of employment with respect to age, the persons between 35 and 64 had the highest occupation rate ranging from 88.7% in 2011 to 91.3% in 2010. The lowest occupation rate is found among those aged between 15 and 24.

Table 2: Evolution of occupation rate in Benin from 2007 to 2011 (%)

	2007	2010	2011
Sex			
Male	78.6	76.1	73.0
Female	76.5	74.6	69.2
Residence			
Urban	70.2	79.5	66.0
Rural	82.3	70.2	75.2
Age group			
15-24	48.5	40.2	40.7
15-34	68.2	63.0	59.3
35-64	90.8	91.3	88.7
Country average	**77.4**	**75.3**	**71.0**

Source: INSAE

2.2.1 Visible and invisible underemployment

Although, a high employment rate is observed, the active population is mostly under-employed in the country. Tables 3 and 4 present the dynamics of visible and invisible underemployment in Benin from 2007 to 2011. While visible underemployment refers to cases where actual working time is inferior to the one set forth by laws and social norms, invisible underemployment refers to inequation between worker's education and earnings. These statistics show that a large part of the workforce works for less than 40 hours per week, which is the legal working time. Visible underemployment follows an increasing trend of underemployment for agricultural workers. It is worth noting that the rate of invisible underemployment for agricultural workers is higher than that of visible underemployment over the period of analysis. About 24.5% of the agricultural workers were in a position of visible underemployment in 2007, compared to 25% and 33% in 2010 and 2011, respectively, while the rate of invisible underemployment amounted to 44.3%, 50.6%, and 54.5% in 2007, 2010, and 2011, respectively. For non-agricultural workers, the rate of invisible underemployment is also higher than that of visible underemployment. When looking at

activity type, agriculture, livestock, fishery, and forestry recorded the highest visible and invisible under-employment over 2007, 2010, and 2011. For example, family labor plays a key role in the agricultural sector, and family size is relatively high in rural areas. On average, the rate of visible underemployment increased from 27% in 2007 to 31% in 2011 in the country. The average rate of invisible underemployment fluctuated, amounting to 45.3%, 55.5%, and 49.6% in 2007, 2010, and 2011, respectively.

Table 3: Evolution of the rate of visible and invisible under-employment from 2007 to 2011 in Benin with respect to the type of jobs and the type of activities (%)

	Visible underemployment			Invisible underemployment		
	2007	**2010**	**2011**	**2007**	**2010**	**2011**
Type of job						
Agricultural	24.5	25.0	33.0	44.3	50.6	54.5
Non-agricultural	29.4	35.2	29.6	46.3	61.7	46.7
Type of activity						
Agriculture, Livestock, Fishery and Forestry	29.4	35.2	33.1	46.3	61.7	54.5
Industry	22.1	24.3	29.1	41.0	53.8	55.6
Water, Electricity and Gas	22.7	11.8	22.9	37.0	25.9	21.7
Building and Related	19.7	17.1	25.0	25.4	33.5	23.3
Commerce and Catering	28.9	27.0	33.0	55.2	61.1	56.9
Transport and Communication	9.4	11.2	7.6	27.6	23.7	17.2
Bank and Insurance	5.7	6.3	6.8	30.5	7.6	7.2
Other services	21.8	28.1	32.8	30.6	35.3	30.0
Undeclared	25.5	58.1	0.0	41.3	53.2	100.0
Total	**27.0**	**29.8**	**31.0**	**45.3**	**55.5**	**49.6**

Source: INSAE 2016

Women are observed to be more under-employed than males, as table 4 shows. In 2007, 2010, and 2011, 18.6%, 24.6%, and 24.9% of males were in a position of visible under-employment, respectively. Both visible and invisible underemployment are higher in rural areas than in urban areas. Disparities in both visible and invisible underemployment are also observed between age groups: the oldest (age group 35-64) had the lowest underemployment rate, while the youngest (age group 15-24) had the highest.

Table 4: Evolution of the rate of visible and invisible under-employment from 2007 to 2011 in Benin with respect t to socio-demographic characteristics (%)

	Visible underemployment			Invisible underemployment		
	2007	**2010**	**2011**	**2007**	**2010**	**2011**
Sex						
Male	18.6	24.6	24.9	37.1	39.7	31.7
Female	34.4	35.3	37.7	52.5	71.3	68.5
Residence						
Urban	69.2	24.5	28.8	8.2	44.9	38.2
Rural	71.2	33.5	33.5	9.8	62.3	58.7
Age group						
15-24	29.0	32.7	33.0	46.1	82.0	73.4
15-34	27.4	31.1	32.1	46.3	64.0	56.5
35-64	26.6	28.6	29.9	44.1	48.4	44.0
Country average	**70.5**	**30.2**	**31.5**	**9.3**	**55.8**	**50.0**

Source: INSAE

Note: The 2007 data are relative to individuals aged at least 10[4].

2.2.2 The case of rice and cotton

In 2010, 72,400 farmers were involved in paddy rice production, of which 15,204 were women (MAEP, 2010). In 2013, cotton and paddy rice production occupied about 11% and 7% of farm households, respectively (République du Benin, 2014). Women are mainly engaged in swamp paddy rice production systems (MAEP, 2010). In paddy rice production, women play a key role in land preparation, seeding, cleaning, harvesting, transport from farms to dwellings, and pre-hulling (MAEP, 2010). It is worth noting that salaried labor and mutual assistance are used in paddy rice production in addition to family labor. Family labor is used in all operations, while salaried labor is used especially for laborious work such as land cleaning, land preparation, and harvesting. The rice value chain creates jobs through extension services and agents and at all stages of commercialization and marketing channels.

Apart from jobs generated by production and processing of seed cotton, many others are created through oil factories. For instance, according to the ONS (2015), since 2003, 1,000 permanent and occasional jobs have been created by oil factories, 500 by the SHB (*Société des*

[4] For a more detailed description of visible and invisible underemployment, see ILO (1995).

Huileries du Bénin), 400 by FLUDOR, and 100 by the IBCG (*Industrie Beninoise des Corps Gras*). Cotton companies have created an estimated 3,500 direct jobs in the country (MEF, 2010). Soulé et al. (2013) found that the cotton industry provides over one million direct agricultural jobs in rural areas and nearly 3,000 jobs in the secondary sector because most industries are based on cotton, with 18 ginning plants, 5 textile mills, and 2 mills producing refined cotton oil. The cotton value chain also provides jobs to the population through research centers (for example the CRA-CF which has a team of 5 permanent agents, 57 contract and casual agents, and about 500 casual workers per campaign). Overall, the cotton value chain directly provides 40% of jobs in rural areas and provides livelihoods to about 50% of the total population (PASCIB, 2013). Incomes from the cotton and rice value chains also create other jobs through their multiplier effects on sectors such as transport, art, commerce, and construction.

Cotton is a strategic sub-sector in Benin because of the importance of its contribution to GDP (13%), jobs (49%), and poverty reduction in rural areas, among other things (MAEP, 2008). Cotton production occupied 325,000 farm households and around 2 million individuals in 2002 and serves as a basis for the domestic spinning industry and the oil industrial sector (Gergely, 2009). The domestic spinning industrial sector covers the entire value chain (spinning, weaving, printing, garment making), but processes less than 2% of the lint due to regular shrinkage (Gergely, 2009). In 2009, there were 135,635 cotton producers, of which 25,901 (19.1%) were women (MEF, 2010, citing AIC 2009).

According to a 2006 joint report of the FAO and the AfDB on the cotton sector in West Africa, each ton of cotton lint represents about 320 man-days of agricultural labor, provided in part by a salaried workforce (MEF, 2010). Figure 1 reports the evolution of job creation over time in the country, depicting a downward trend in cotton lint production over the last decade. In addition to this agricultural employment, there are an estimated 3,500 other direct jobs created by cotton companies in the country (MEF, 2010).

3 Rice and Cotton Value Chains in Senegal and Benin

In this section, we describe both value chains in both countries, with the goals of understanding employment and income generation potentials therein.

3.1 The cotton value chain in Benin and Senegal

Cotton plays an important role in the global economy and continues to be a topic of contention in multilateral trade negotiations. Cotton represents a sheer share of world exports. West Africa's main cotton-producing countries are Burkina Faso, Mali, Ivoire, Benin and Togo. Senegal's production is marginal, at less than 50,000 tons per year, compared to that of Burkina Faso or Benin. The cotton in the area is rainfed, and cotton producers use primarily manual systems of production, including for harvesting. This value chain is the main source of income for more than 15 million people and occupies almost 70% of the working population in the sub region. Cotton companies also maintain rural infrastructure and indirectly support food crops (Zola and Knappe, 2014). However, despite efforts to improve productivity (providing research funding for quality seed, for example), yields remain low.

3.1.1 Cotton value chain in Senegal

Cotton production began in Senegal after its independence from the French textile development company (CFDT) as a way of diversifying agriculture, which is heavily dominated by groundnuts. Cotton is grown in three regions: Tambacounda, Kolda, and Kaolack. SODEFITEX, which was set up in 1974, is the only company that remains active in the cotton industry in Senegal. It contributed 3% to GDP and 5% to national exports and employed between 34,000 and 71,000 people in 1998.Senegal has an estimated production of 32,250 tons of cotton seed and 13,630 tons of fiber cotton. This represents 1.83% of total production in WAEMU. In short, Senegal is considered a small cotton producer in the West African context. This weak competitiveness of Senegal compared to other African countries is explained by several factors (Zola and Knappe, 2014).

The production of cotton is characterized by erratic growth. Production declines are more frequent and larger in volume than increases in production. The most drastic decreases were observed in the 1992-1993 season (50%) and the 1998-1999 season (71%). This decline, despite the intervention of SODEFITEX, which moved the floor price from 170f / kg to 185f / kg, discouraged cotton producers. Thus, the number of cotton producers went from 71,000 in 1998 to 34,000 at the beginning of 2000. More than half abandoned the cotton crop because of the low yields, estimated at 240 kg / ha. Thanks to state support under GOANA combined with SODEFITEX's actions, cotton production slightly improved between 2002 and 2007 and dropped again in 2008. This poor performance is linked to an often-unpredictable rainfall, the

volatility of fiber prices, the trafficking of subsidized inputs by the State, and challenges in controlling pest attacks.

The production areas

Unlike other speculations, cotton production is not widespread on Senegalese territory. It is concentrated in the south of the country in Tambacounda, Bakel and Upper Casamance.

The main actors of the value chain

The cotton value chain is organized around SODEFITEX, which buys the cotton from producers and transforms it in its factories before reselling it on the international market. SODEFITEX is very much involved in the production of cotton. SODEFITEX intervenes at all levels of the value chain: identification of production capacities, determination of input requirements, provision of seeds, centralization of equipment needs, ordering of various supplies, credit granting, credit management with the CNCAS, and harvesting. It supplies inputs to producers (seed, fertilizer, fungicide, and herbicide) and buys their products.

In terms of processing and marketing, only SODEFITEX is responsible for ginning. It has five seed cotton ginning factories located in Kahone, Tambacounda, Kedougou, Velingara, and Kolda, with a total annual capacity of 65,000 tons. Seed trituration is the responsibility of the Sunéor. The commercialization of cotton fibers and seeds takes place in a formal circuit organized by SODEFITEX. Cotton producers are organized by the National Federation of Cotton Producers (FNPC).

Financing modalities and funds involved

Rainfed crops that occupy 90% of the agricultural labor force are increasingly neglected by the government. Since the mid-1990s, more than 70% of public investment has been devoted to irrigated agriculture. Again, cotton is not an irrigated crop. Investment in agriculture increased significantly between 2013 and 2015, from 27,419 million to 126,034 million CFA. This investment has mainly been used to increase the stock of capital and infrastructure, improve factor productivity and facilitate access to credit (DPEE, 2013). The share of this investment going to cotton is very low compared to those for other agricultural products.

Water supply system and investments

The cotton producing area, apart from Casamance, is the rainiest area in Senegal. The recorded rainfall is 1129.7 mm for Kedougou, 680.9 mm for Tambacounda, and 772.6 mm for Velingara per year. However, this rainfall decreased from 800 to 900 mm in Tambacounda and 1240 mm in Kedougou between 1951 and 1998.

3.1.2 The cotton value chain in Benin

Cotton was introduced in Benin in 1946. Cotton is produced in four zones; the northern zone (Alibori, and Atacora areas), the north-central zone (Borgou and Donga areas), the central zone (Zou, and Collines areas) and the southern zone (Ouémé, Plateau, Couffo, and Momo areas). The northern and north-central zones are best suited for cotton production in terms of agroclimatic conditions (Gergely, 2009). Animal traction and herbicides are less frequently used in the southern zones compared to the northern ones.

The AIC (*Association Interprofessionnelle du Coton*) currently ensures the management of the subsector. The AIC brings together producers, ginners, and input suppliers. The negotiations between ginners and producers to set the annual pre-determined fixed price for cotton are done through the AIC (Gergely, 2009). This inter-professional body has the mandate to organize the marketing of cotton, the collection and distribution of seed cotton to the ginners with respect to the annual quota. In addition, it is in charge of the organization of seed cotton markets at the village level, seed provision, research, extension, grading of cotton, quality control, and rural infrastructure. Although the government has withdrawn from strategic links to the chain, it continues to support it through subsidies. The organization of input supply is under the responsibility of the *Coopérative d'Approvisionnement et de Gestion en Intrants Agricoles* (CAGIA). Ginners process seed cotton to transform it into cotton lint. In addition, oil plants such as FLUDOR BENIN S.A., IBCG, and SHB produce oils based on cotton seed, and textile plants produce textile products based on cotton lint.

Producers' organizations

Until 2006, producers were organized into groups at the village level (Groupements Villageois - GV), communal level (Union Communale des Producteurs de Coton – UCPC), regional level (Union Départementale des Producteurs de Coton – UDPC), and national level (Association Nationale des Producteurs de Coton – ANPC). The organizational scheme of producers' associations has been changed by a 2006 government decree. Thus, the National Council of Cotton Producers (Conseil National des Producteurs de Coton – CNPC[5])[6] has been created, and the ANPC, which is the largest organized network of cotton producers with 90% of production, prevails within the CNPC. In 2010, the AIC, supported by the Government, reorganized the structures at village level with the leaders of CNPC and ANPC. The Coopératives Villageoises des Producteurs de Coton (CVPC) were thus created. To track production campaigns and marketing, the Government and AIC created the Comités Communaux de Suivi de la Production Cotonnière (CCSPC), which replaced the CCPC.

[5] The Conseil Départemental des Producteurs de Coton (CDPC), and the Conseil Communal des Producteurs de Coton (CCPC) were created at department and community level, respectively.

[6] The Conseil National des Importateurs et Distributeurs de Coton (CNIDIC), and the Conseil National des Egreneurs de Coton (CNEC) were also created.

Financing modalities and funds involved

Since the withdrawal of the government from the strategic links to the chain, it continues to support the subsector through subsidies. To guarantee a minimum income to producers, the government intervenes in supporting the sector through important funds (ONS,[7] 2015): exemption of cotton inputs from customs, subsidizing seed cotton purchase price to producers, subsidizing input prices to producers, supporting funding for certain critical functions of AIC, and pre-financing to settle the accounts of some actors.

Water supply system and investments

Cotton production is rain-fed in Benin. Therefore, most investment made in cotton production is related to water management. Moreover, as the production system is mainly traditional, mechanization is still very rare, although the government has committed itself to mechanizing the agricultural sector. Tractors have been purchased from Asia for that purpose although many of them are not currently working.

Resilience and adaptation to climate change

Analysis of the sensitivity of the crop production sector revealed that drought, severe water shortages, floods, and other water excesses in the soil are the major climate risks affecting the sector across the country. Smallholder farmers, herders, and fishermen are the most exposed to climate risks. Food production, animal husbandry, fishing and commercial agriculture are the most affected by climate and hydrological risks (MEHU, 2011). Being a perennial plant, cotton has long been grown as an annual crop, according to the International Trade Centre (ITC, 2011). It needs between 105 and 125 days of sufficient soil moisture to grow and is resilient to sub-optimal growing conditions (ITC, 2011). The ITC argues that cotton production could decrease following rainfall reduction and could move southwards to more humid areas. Generally, water availability will be the critical factor for cotton production, and an increase in the frequency and intensity of extreme events, such as droughts and floods, will affect crop production (ITC, 2011). Lokonon (2015) found that 57.43% of the farm households in the Niger basin of Benin are vulnerable to climate shocks. Among these vulnerable farm households, 55.27% (37.74% of overall households) are very vulnerable to climate shocks. Therefore, the resilience level is very low in the basin.

3.2 The rice value chain in Benin and Senegal

Rice is produced in both Senegal and Benin. However, this product does not occupy the same place in both countries at the level of the production system (irrigated in Senegal and rainfall in Benin) or consumption level (a consumption model based on rice in Senegal) but above all

[7] Office National de Soutien des Revenus Agricoles

because of the model of peasant organization structuring the value chain. These factors contribute to determining the employment dynamics in both countries in the rice value chain.

3.2.1 The rice value chain in Senegal

Producers' organizations

In the delta, public facilities are occupied by former producer groups converted into Economic Interest Groups (GIEs) or village sections and then regrouped into unions to manage common facilities such as pumping stations, shops, and rice mills. In the Anambé Basin, the vast majority of farms adhere to GIEs that are members of the associations of the Anambé Basin Producers' Federation (FEBROBA). The FEBROBA was created in 2000 and consists of four (4) unions, six (6) sectors and 217 Economic Interest Groups (GIEs). Each union gathers basic GIEs that share the same hydraulic mesh controlled by a pumping station. Thus, the GIEs of the same union are active in the same developed area. In rainfall areas, private associations dominate the landscape.

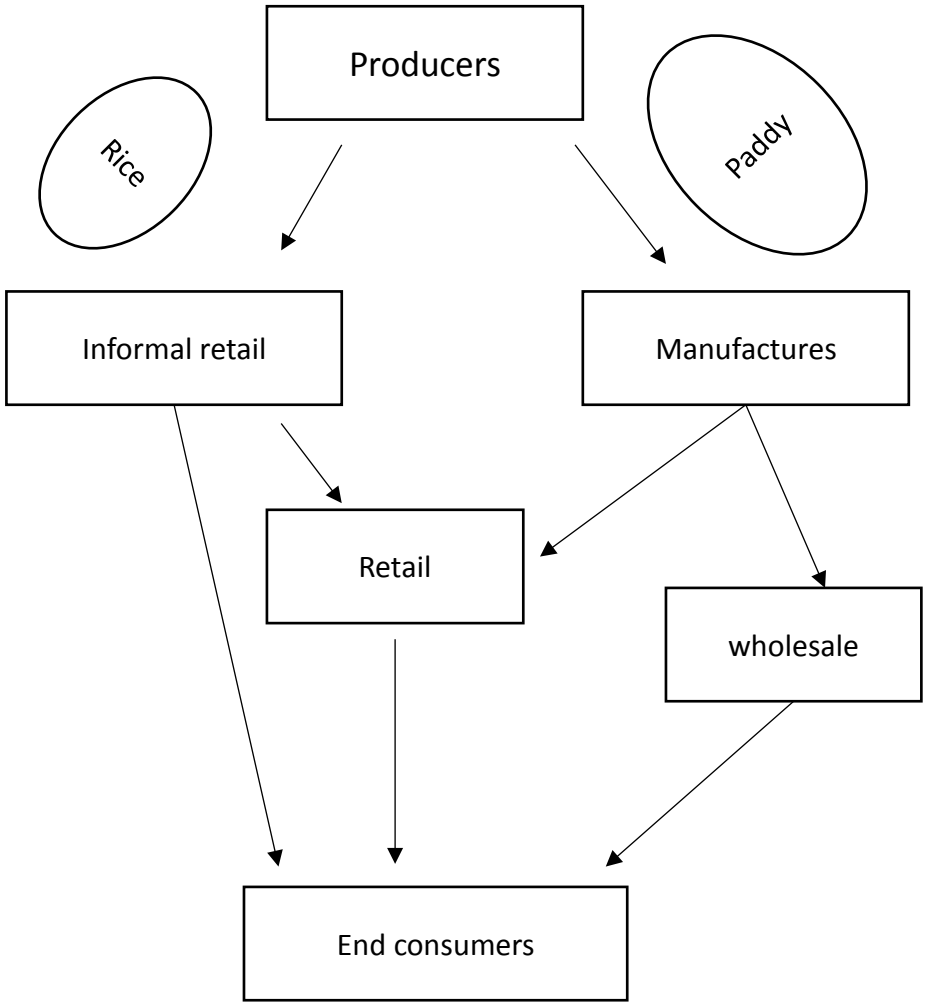
Financing modalities, and funds involved

The 2008 crisis caused the rise of rice prices by a rate ranging from 50 to 100% in West Africa. The world price of Thai 25, the rice variety imported most by Senegal, almost tripled in mid-2008 (FAO, 2009). In April 2008, at the beginning of the crisis, Senegal launched the GOANA (Great Agricultural Offensive for Food and Abundance). In this program, massive investments in the local rice sector were made with an ambitious goal of achieving food self-sufficiency by 2015.

Product marketing channels

Several actors intervene in the marketing channel. Collectors, wholesalers, semi-wholesalers and retailers intervene after production. These categories are differentiated according to financial capacity, sales volume and mobility. Wholesalers are located in urban centers and are supplied by the collectors.

Figure 1: Channels of rice commercialization



Source: Fall (2015)

Water supply system and investments

In Senegal, there are two rice production systems: irrigated and rainfed. Rainfed rice cultivated 78,000 ha and contributed 150,000 tons of paddy, or 30% of national production. National average annual production is 500,000 to 600,000 tons of paddy (PNAR[8]). The investments made by the Senegalese government to control water have boosted paddy production.

The distribution and processing system

Local marketed rice is often produced from irrigated rice farms, whereas rainfed rice is mainly intended for self-consumption. Several actors intervene in the marketing of rice in the valley of the river and in the Anambé basin. Processing is carried out by the producers themselves

[8] PANR: Programme National d'Autosuffisance en Riz -Sénégal (2011)

or by the service providers whose principal activity is processing. Processing units can be divided into three groups in irrigated production areas. There are village huskers who process 75 to 80% of the national product. These hullers have low capacity not exceeding 100 bags per day. However, 343 units, or 93% of the processing units, are fairly large in the irrigated area and represent a processing capacity of 160,000 tons (SAED, 2011). Additionally, there is semi-industrial and industrial processing, which processes 20 to 25% of the national production. It comprises 41 units, of which 26 are functional and produce better quality rice, according to the required standards. However, some producers do their own processing and marketing.

Adopted innovations and impacts on yields

Rice Integrated Crop Management (RICM) interventions throughout the valley with the use of improved varieties have contributed to increasing yields from 3.8 t / ha to 5.5 t / ha (Defoer et al., 2004). Rice growth models predict a potential yield of irrigated rice in the Sahel of 9-12t/ha (Dingkuhnand and Sow, 1997). This was confirmed at the farm level, where yields of 12t/ha were reported in the warm and dry season (Wopereis et al., 1999) and even during the rainy season by some producers who were surveyed in this study. Despite this performance, the gap between firm and potential returns is still substantial.

3.2.2 Rice value chain in Benin

Since independence, the promotion of paddy rice in Benin has been emphasized, mainly through various development policies (Konnon et al., 2014). These development policies were based on the assumption that Benin can produce paddy rice to meet its local demand as well as part of the demand arising from neighboring countries, especially Nigeria (MAEP, 2011). Benin has 322,900 ha of irrigable land, of which 117,000 ha are flood-plains and 205,900 ha are swamps (MAEP, 2010; Konnon et al., 2014 citing CBF/DGR, 2000). The country therefore has non-negligible natural resources for paddy rice production. The Zou and Collines areas appear to have the largest swamp potential, followed by Atacora – Donga, Borgou – Alibori, Ouémé – Plateau, Mono – Couffo, and Atlantique. Littoral region (Cotonou) is not included in this distribution despite having swamps due to its status as economic capital city of the country.

To facilitate paddy processing and consumer access to rice, the government has built two large mills in the Malanville and Glazoué areas (Konnon et al., 2014). These mills are under the stewardship of SONAPRA. The government has set up, through the Ministry of Agriculture, several research, management, and extension institutions to address the challenges facing the sector. The processing link of the chain is improving with the installation of artisanal types of processing units, 6 semi-industrial (8 tons/day) and 2 industrial (150 tons/day). Paddy processors operate in groups or individually in shelling and parboiling. Industrial and semi-industrial-type units include all actions from shelling to packaging (MAEP, 2010). Mills and

inefficient hulling facilities are still widespread. However, integrated mini rice mills and two large modern rice mills have been recently set up (Konnon et al., 2014). According to Konnon et al. (2014), it is not possible to estimate the share of the potential in rice production that is actually being used because this has not yet been studied properly.

Producers' organizations

Most of the rice producers are members of the Conseil de Concertation des Riziculteurs du Bénin (Consultation Council of Rice Producers of Benin - CCR-B), which is the national organization of paddy rice producers in Benin. The CCR-B was established in May 2006. It is composed of six regional rice producers' unions (URR) which are made up of community-level rice producers' unions (UCR). The UCR are made up of rice producers' groups from villages (Coopératives Villageoises de Producteurs de Riz - CVPR).

Financing modalities and funds involved

Currently, paddy production is to some extent subsidized by the government through facilitated access to fertilizers and certified seeds for producers. Rice producers pay the CFA F 11,000 or 10,000 per bag of fertilizers (the same prices as for cotton producers), while the actual price is between 16,000 and 17,000 (Konnon et al., 2014). In addition, certified seeds have been 100% subsidized since 2008.

Water supply systems and investments

Paddy rice is mainly produced by smallholder farm households. Additionally, commercial-type paddy rice production is emerging slowly. Three main types of production systems are found in Benin: rain-fed systems, swamp systems, and irrigated systems (Konnon et al., 2014). The swamp systems appear to be the largest (54.03%). Full irrigation and supplementary irrigation are still low (8.64%, and 13.97%, respectively).

Gender balance

Rice traders in Benin are predominantly women. They ensure the collection and delivery of local rice from production areas to consumption areas and the delivery of imported rice to consumption places (MAEP, 2010). There are various types of traders, namely collectors, wholesalers and retailers.

Financing and distribution

The main microfinance institutions that operate in rice value chain are local branches of agricultural credit and of the Faîtière des Caisses d'Epargne et de Crédit Agricole Mutuel (FECECAM-Benin) network. In addition, producers have access to credit from informal structures. It should be noted that given the high risks associated with agricultural activities,

large commercial banks dare not invest in the sector. Consumers are at the end of the rice marketing system.

Level of processing, sophistication, and value added

In general, the level of sophistication of the processing equipment is low. Sorting of grains and polishing are not yet well known in the rice milling process in Benin (Konnon et al., 2014). The rice processing activity is a crucial stage in the production of edible rice. This stage is done by adding value to paddy to present a quality product to end consumers. Paddy rice processing is done in a set of activities that allow rice to pass from paddy to shell rice. There are two paddy processing systems: hulling after parboiling and direct hulling without parboiling. Hulling after parboiling is the most prevalent system in the country. Although parboiling is done mainly traditionally in this system, improved parboiling has begun to be used because of the associations of women that process rice (Konnon et al., 2014). It is worth noting that the quality of the local rice is still low when compared with imported rice.

4 Relationships between value chains, jobs, and income generation: an empirical assessment

In this section, we analyze the relationship between value chains, income and employment in Benin and Senegal. The methodological approach we use is twofold: a) we use survey data when available to compute relational descriptive statistics on the effect of these two sets of variables, b) we use an inputs-outputs approach to compute multiplier effects of value chains on income and employment.

4.1 A descriptive statistical analysis

The data used in this section comes from the EJAMO database (Hathie et al., 2015). It was collected in 2013 through household surveys. The surveys collected information on 1,500 households in the Groundnut Basin, the Senegal River Delta and the Niayes. In the three agroclimatic zones considered, there was a reasoned choice of village on the basis of economic and sociological differentiation. Households for each village were then randomly drawn. The delta river basin contains the bulk of irrigated rice cultivation, transportation, and transformation in Senegal while other areas mainly produce other speculations such as vegetables, groundnut and cereals. The type of organization observed for rice in the delta is very different from those in other areas. We observe an ecosystem of rice production, mainly organized around a clear value chain, with a clear distribution of functions on diverse and vertically integrated activities, while for other speculation no such organization exists. Comparing both sets of areas is thus likely to shed a light on the relationship between value chains and income and employments levels and patterns.

4.1.1 Socio-demographic characteristics of labor and households

Unsurprisingly, figure 2 and table 5 show that gender does not differ much in either set of areas. The gender distribution of the rural labor force shows that women are more active in the labor market in the rice production area (52.3%) than other areas (48.8%). When one considers the distribution by sex and age of the rural labor force, young women are the majority in both the rice production area and the other rural areas of Senegal.

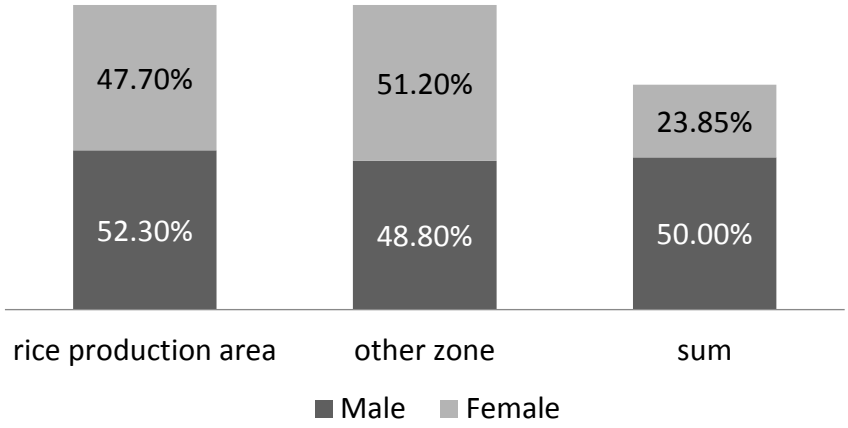


Figure 2: Labour force share by sex in Senegal

Table 5: Labour force share by gender and by age in Senegal

	Rice production area		Other areas	
Age group	**Male**	**Female**	**Male**	**Female**
10 -14 years old	14.7%	16.6%	20.20%	17.27%
15 -19 years old	20.0%	15.2%	18.74%	17.21%
20 - 24 years old	12.1%	12.3%	11.59%	12.56%
25 - 29 years old	9.1%	9.5%	8.82%	11.29%
30 - 34 years old	8.4%	9.2%	5.42%	9.49%
35 - 39 years old	7.2%	10.0%	4.50%	7.36%
40 - 44 years old	6.7%	8.1%	4.80%	5.71%
45 - 49 years old	5.6%	6.0%	4.52%	4.97%
50 - 54 years old	4.9%	5.7%	3.34%	5.11%
55 - 59 years old	3.3%	3.0%	3.91%	2.95%
60 - 64 years old	3.7%	2.6%	2.76%	2.50%
65 - 69 years old	2.0%	0.8%	2.11%	1.15%
70 - 74 years old	1.2%	0.3%	1.07%	1.28%
75 - 79 years old	0.4%	0.3%	0.71%	0.68%
80 - 84 years old	0.5%	0.3%	0.59%	0.25%
85 years old and over	0.2%	0.1%	0.17%	0.22%

Source: EJMAO (2015)

When we consider the level of education of the labor force, we note that the bulk of the rural labor force in rice production has a level of education that does not exceed the primary level (34.7 % of men and 41.3% of women). However, it is much higher than in non-rice producing areas: 15% of the rural workforce in the rice production area has an average level of elementary education attainment, compared to only 7% in other areas. The same applies to the level of secondary education, which includes 3.8 per cent of the labor force in the rice production area and only .05 per cent of the labor force in the other zones (figure 3).

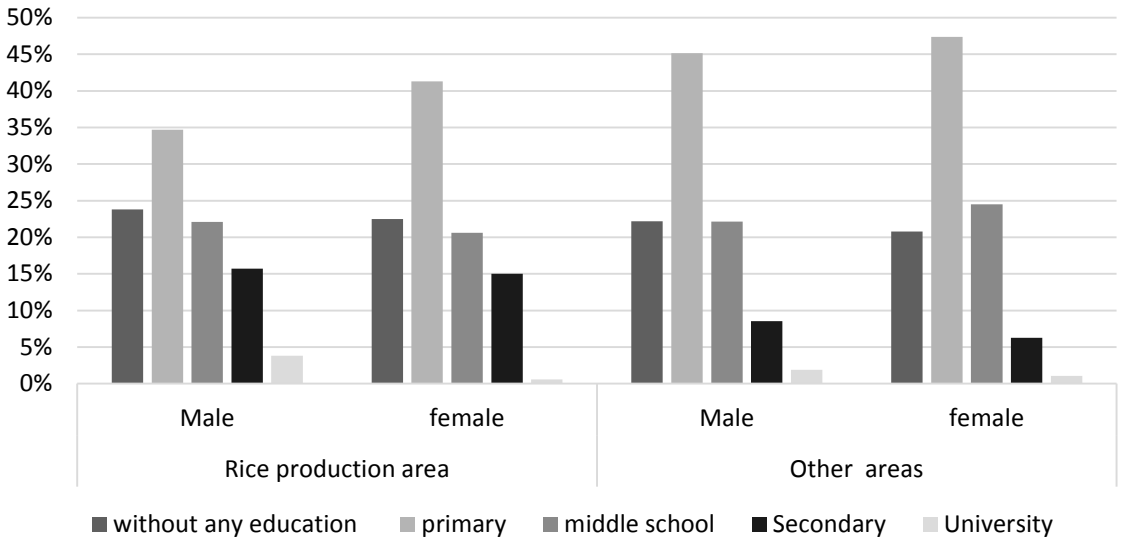


Figure 3: Rural labor force level of education in Senegal

Source: Data from EJMAO, and authors' calculations

Household size is another distinctive feature within this data, with households in the Senegal River Delta being slightly smaller than elsewhere (table 6). Moreover, the average age of the head of household is 50 years in the rice producing areas, compared to 53 years for other zones. However, it is in the rice production area that we find the highest probability of having male heads of households (95%) compared to 89% in other areas.

Table 6: Rural labor force level of education in Senegal

Household characteristics	Rice producing area	other areas	total
Household mean size	9.4	10.7	10.8
Average number of persons over 10 years old in the household	6.8	7.45	7.5
% male household heads	95%	89%	90%
% female household heads	5%	12%	10%
Average age of the household head	50.5	53.8	53.2

Source: Data from EJMAO, and authors' calculations

The structure of the age of the labor force does not significantly differ between rice production and other areas. Young people (aged 15-34) account for 48.9% and 49.8% of the labor force in rice production and other areas, respectively (figure 4). Likewise, it is in the rice production area that most households have slightly more production units than other agro-ecological zones (figure 4).

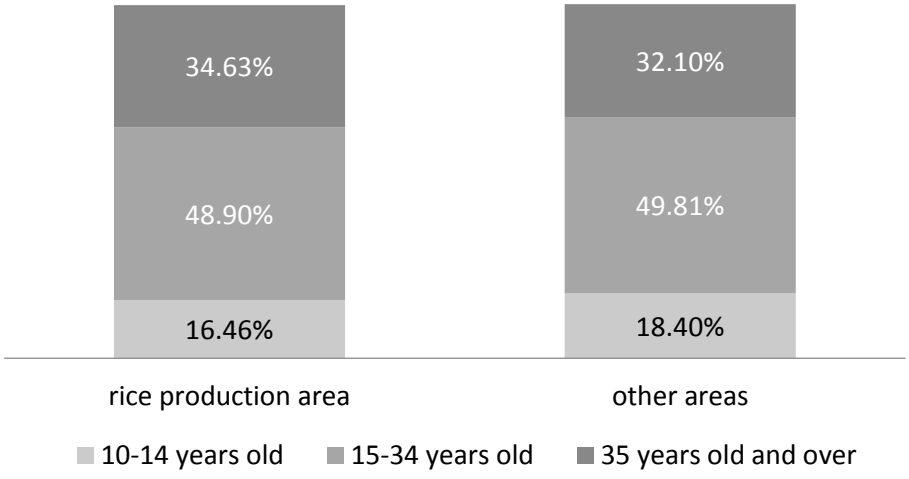


Figure 4: Age structure of the working-age population in Senegal

Source: Data from EJMAO, and authors' calculations

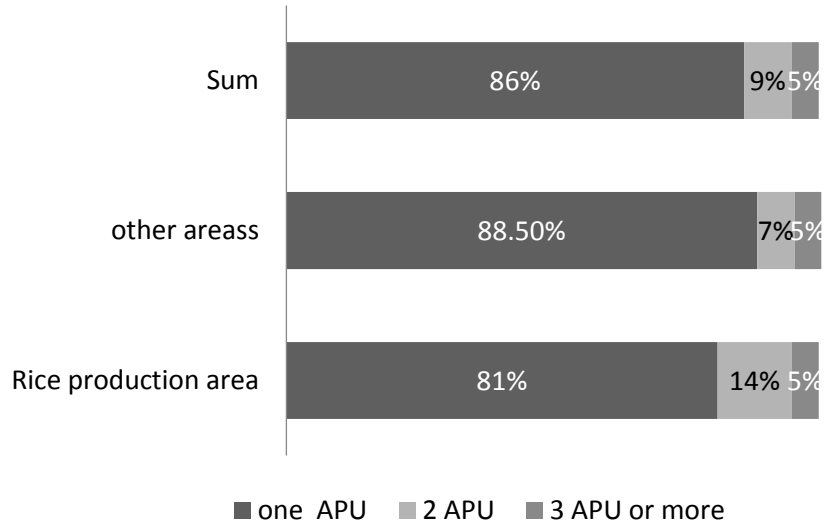


Figure 5: Distribution of the number of Agricultural Production Units (APU) by area in Senegal

Source: Data from EJMAO, and authors' calculations

A large majority of family laborers work permanently on the family farm, in both rice production and other areas (figure 5). However, much of the external labor force employed on family farms in the rice production area comes from other agro-ecological regions through internal migration (58.17%). In the other areas, in contrast, the external labor force comes mainly from the same village (67%) (table 7). In the delta of the Senegal River, external labor mainly works in harvesting activities (55.20%), unlike in other areas (29.7%). Much of the external workforce (39%) in other areas works in other maintenance activities. The gender distribution of the labor force shows that women are more active in the labor market in the rice production area (52.30%) compared to other areas (48.8%).

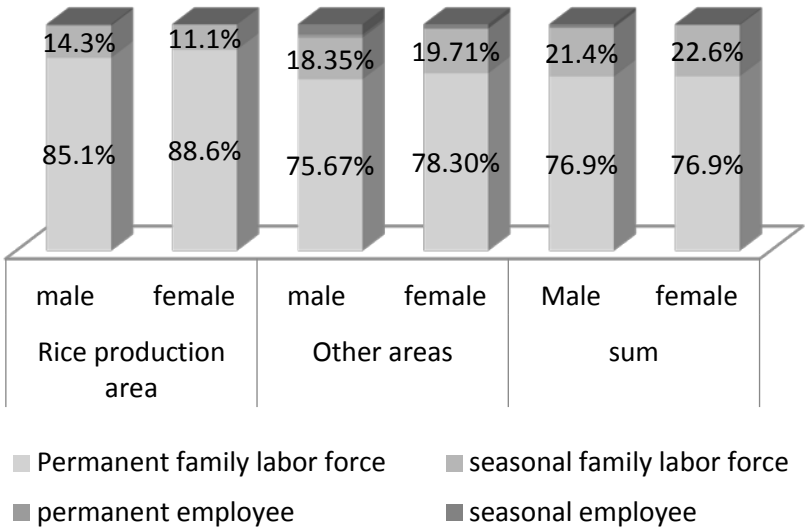


Figure 6: Status of the family labor force on the farm in Senegal

Source: Data from EJMAO, and authors' calculations

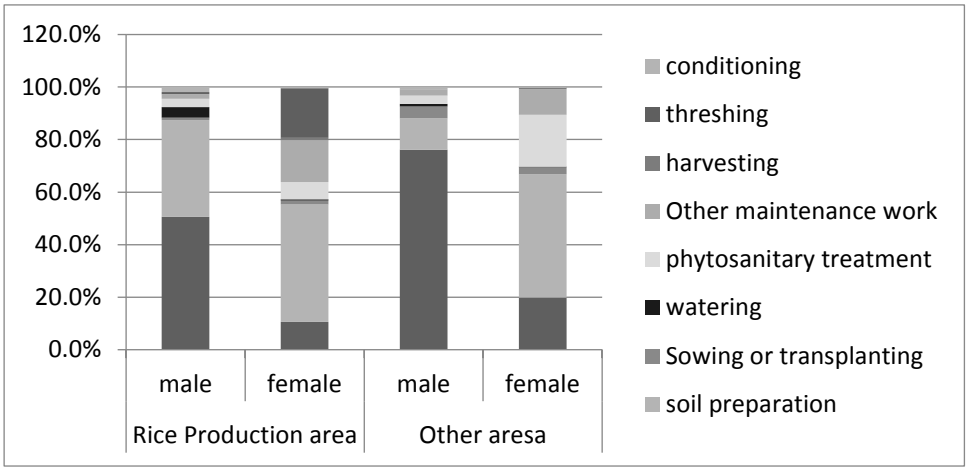


Figure 7: Tasks of the family labor force in the farm in Senegal

Source: Data from EJMAO, and authors' calculations

Table 7: Origin of the external workforce in Senegal

	Rice production	Other areas
From the same village	30.57%	67.73%
From a neighbouring village	10.19%	14.32%
migration	58.17%	16.66%
not available	1.06%	1.30%

Source: Data from EJMAO, and authors' calculations

In summary, apart from the level of education, socio-demographic characteristics of households in both sets of areas seem similar.

The dependency rate is lower in the delta than in other areas: 0.4 compared to 0.5.

Table 8: Some rural labor force indicators in Senegal

	Others areas	Rice production area	total
Number of employed persons by household (10 years old or more)	5.4	3.5	5.1
Dependency rate	53%	43%	49%

Source: Data from EJMAO, and authors' calculations

4.1.2 The patterns of payment

The modalities of compensation do differ in rice-producing areas, as compared to other areas. Most of the external labor is paid in cash in the rice production area (more than 80%), while in the other zones, only 46% are paid in cash (figure 8). Seasonality is another distinctive feature between the two kinds of areas. In non-rice producing areas, 22% of the male workforce and 28% of the female workforce working on family farms do their agricultural activity exclusively during the rainy season. By contrast, in the irrigated/managed rice-producing areas, 32% of men and 31% of women work in agriculture both in the rainy and in the dry season (figure 9). For external labor, as for family labor, they are mainly active during the rainy season in non-rice production zones. In the river delta, where rice production is carried out, the external workforce works mostly in the off-season (83%, figure 10). This can be explained by the fact that this external workforce takes advantage of the seasonal nature of agriculture in its area of origin to migrate to the delta and go back to their areas of origin during the rainy season.

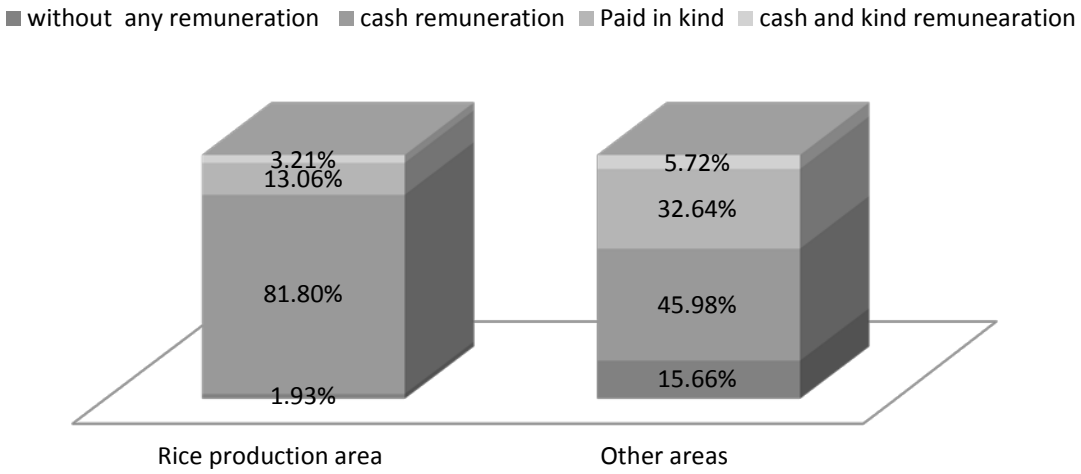


Figure 8: Tasks of the external labor force in the farm in Senegal

Source: Data from EJMAO, and authors' calculations

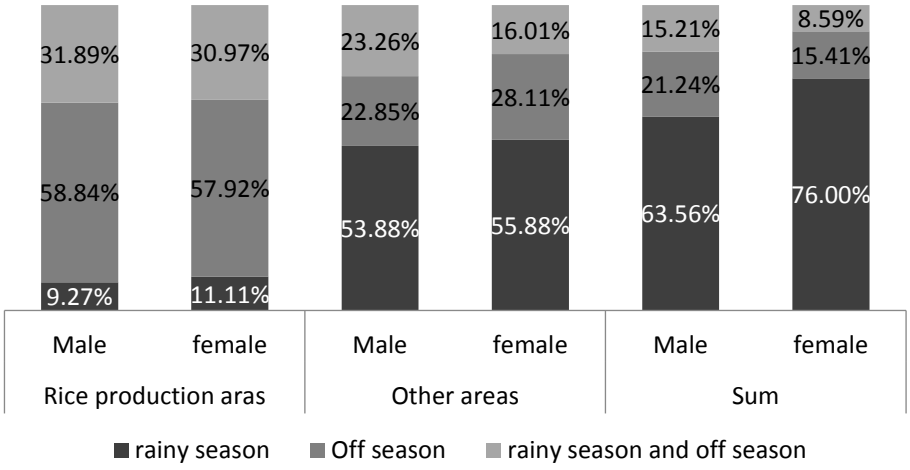
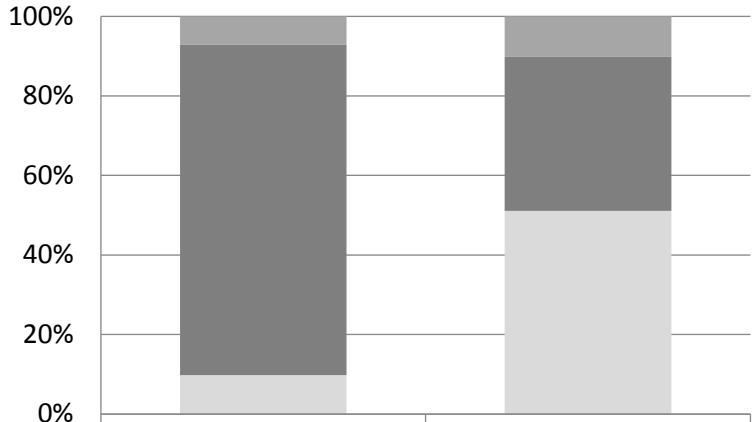


Figure 9: Seasonal activity of family labor force in Senegal

Source: Data from EJMAO, and authors' calculations



	Rice production area	Other areas
rainy season and off season	7.05%	10.19%
Off season	83.12%	38.71%
rainy season	9.83%	51.10%

Figure 10: Period of activity of non-family labor force in Senegal

Source: Data from EJMAO, and authors' calculations

On average, we do not observe large differences in farm size between zones. Farm size in the delta river area is around 2.9 hectares while it is slightly less in non-rice producing zones, at (2.7%) (table 9).

Table 9: Average land area held by rural households in Senegal (ha)

Agro-ecological areas	Mean	Standard deviation-	minimum	maximum
Other areas	2.79	3.69	0	57.37
Rice production areas	2.98	4.92	0	60
Sum	3.06	4.45	0	76.75

Source: Data from EJMAO, and authors' calculations

Only 5% of households in the rice production zone receive transfers of money from internal migrants, while 33% of households in other areas receive them (table 10).

Table 10: Households receiving remittances from migrants in Senegal

	Rice production area		Other areas	
	Total	**Percentage**	**Total**	**Percentage**
Household receiving transfers	22	5,60%	181,5	33,12%
Household without transfers	374	94,40%	366,5	66,88%
Total	396	100,00%	548	100,00%

Source: Data from EJMAO, and authors' calculations

While very few differences are observed between rice-producing and other areas in terms of household characteristics, levels of income and assets are much higher in the former area. Our statistical mean difference tests show a significant difference between income in both areas (at 5% significance level). These differences hold both for farm income and for non-farm income.

4.1.3 Employment patterns

Several trends characterize employment in both sets of areas. First, many non-farm activities coexist with on-farm activities. They encompass: trades, handicrafts, transport and services. The graph below shows the distribution of non-agricultural activities by area:

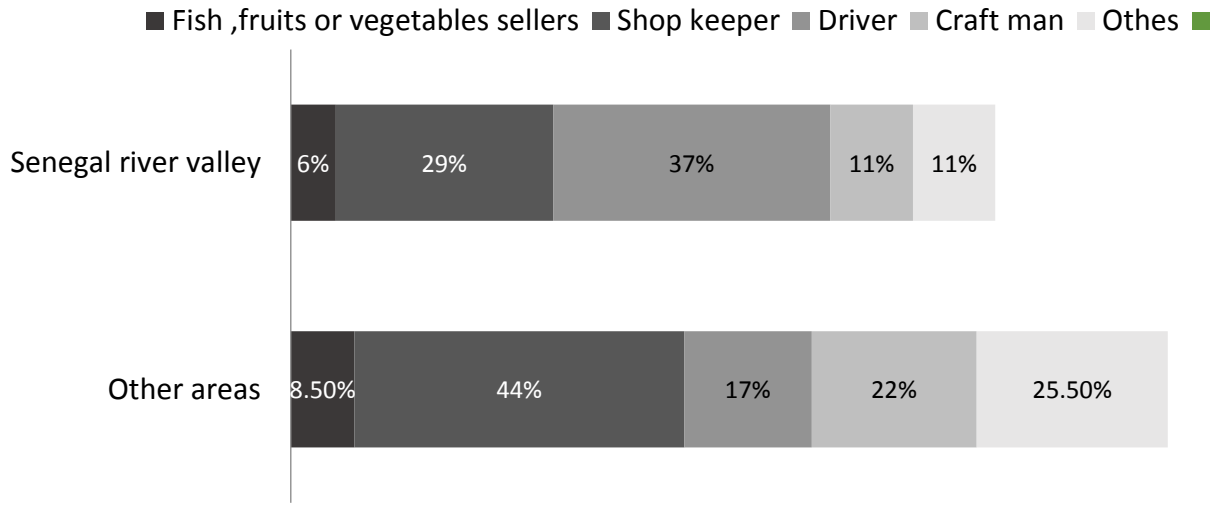


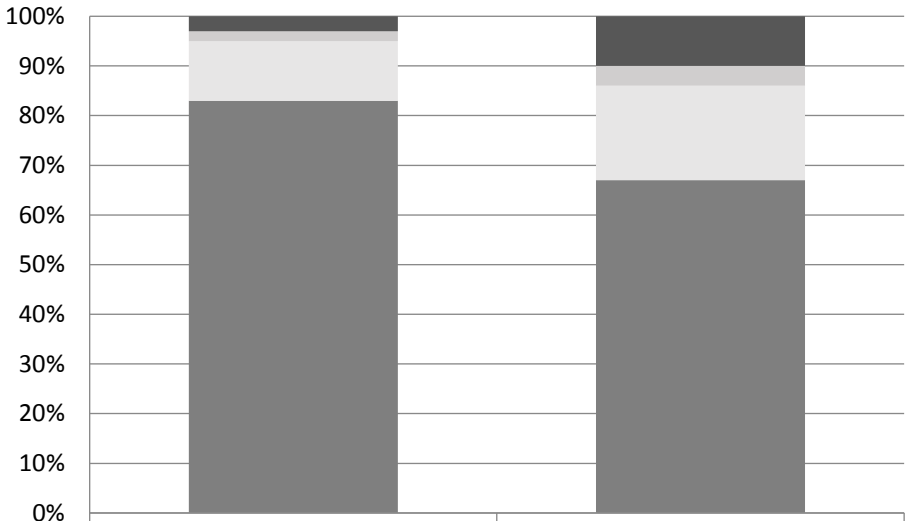
Figure 11: Structure of handicrafts and trade by area in Senegal

Source: Data from EJMAO, and authors' calculations

There is a gender-based difference in the practice of these non-agricultural rural activities. Women mostly carry out activities such as trading (sale of food products), service (peanut seeds husking, winnowing, etc.), and handicrafts (hairdressing, sewing) as well as the processing of local agricultural products (peanut oil and butter).

Men are more likely to be in the transportation system (cars, horses, etc.) and in craft work in a wide variety of trades, including mechanics, building (masonry), carpentry, sewing, and shoe repair. Women dominate non-agricultural activities. In the *Bassin Arachidier*, 71% of owners of UPNAs are women. In the Niayes women represent 63% of UPNA owners and 49% in the delta.

The attractiveness of non-farm activities for women can also be explained by barriers of all kinds. The main characteristic of non-farm activities is that they constitute an independent activity (self-employment) for most owners. Indeed, the majority of non-farm activity heads (78% in the *Bassin Arachidier*, 88% in the Niayes and 67% in the delta) carry out their activities without employees or use of family labor.



	Other areas	Senegal river Valley
External labor forece	3%	10%
Family worker and External labor force	2%	4%
Family worker	12%	19%
Self employment	83%	67%

Figure 12: Distribution of types of labor used by UPNAs in Senegal

Source: Data from EJMAO, and authors' calculations

The wage-earning system concerns agricultural and non-agricultural activities and occupies a relatively small share of assets in all three areas. The agricultural wage earner is almost non-

existent in the *Bassin Arachidier* (0.2% of the working population) (out of 4561 assets identified in the *Bassin Arachidier*, there are only 9 agricultural workers). There is no migrant labor in the *Bassin Arachidier.* Wage-earning jobs are relatively uncommon in the Niayes (3%) and the delta (2%).

Non-agricultural wage earners hold a relatively higher percentage of assets in the delta (16%) compared to the *Bassin Arachidier* (9%) and to the Niayes (10%).

The majority of the rural labor force in all study areas do not have contracts with their employers regardless of whether it is their primary or secondary activity. In fact, in the *Bassin Arachidier*, more than 80% of the workers claimed to not have any type of contract with their employers; that percentage is 55% and 52% respectively in the Niayes and the delta.

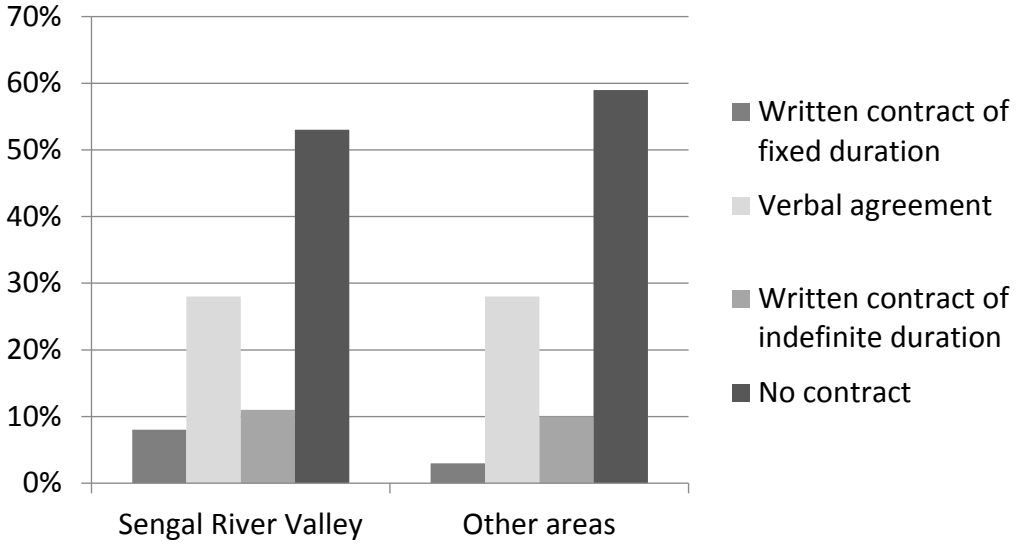


Figure 13: Types of contracts in the primary activity in Senegal

Source: Data from EJMAO, and authors' calculations

4.2 An input-output model and multiplier effects

The Leontief input-output model is an important tool for simulating the impact of output variation on value-added and employment. It encompasses three main elements: a) an inter-industry exchange component which displays the set of outputs that have been transformed or completed in the production process; b) a final uses matrix component which encompasses consumer expenditure, government public expenditure, and investments (both gross fixed capital formation and change in inventories; and c) the primary input component, which shows at the product level how value-added elements break down into wages and salaries, interests and profits, depreciation, and taxes.

Several important accounting identities can be derived for each branch product from these components, namely:

1. Gross output = intermediate consumption from branch + total use of the product output
2. Gross output = intermediate consumption from branch + primary inputs (labor, capital, land) = branch total costs.

The basic structure of the model is:

$$x_1 = z_{11}^d + z_{12}^d + \cdots + z_{1n}^d + \bar{y}_1^d$$

$$x_1 = z_{11}^d + z_{12}^d + \cdots + z_{1n}^d + \bar{y}_i^d$$

$$x_n = z_{n1}^d + z_{n2}^d + \cdots + z_{nn}^d + \bar{y}_n^d$$

Where *x* stand for output, *z* and *y* stand for intermediate and final demands, respectively.

In matrix form, it can be presented as follow:

$$A^d = Z^d \hat{x}^{-1} = \begin{bmatrix} a_{11}^d & \cdots & a_{1n}^d \\ \vdots & \ddots & \vdots \\ a_{n1}^d & \cdots & a_{nn}^d \end{bmatrix}, \text{ with } \quad x = a^d x + \bar{y}^d$$

This structure is representative of a demand-driven model, with the assumption that demand-side constraints to output growth are more binding than supply-side ones. Under this assumption, the model allows for simulations on the effects of variations in final uses (final demand) of branch product on all inputs (intermediate as well as primary) the given branch consumes. The Leontief inverse matrix relates final demand of branch product *j* with required intermediate and primary inputs from other branches based on technical coefficients of output *j* with respect to each category of input. Hence the *Iij* element of the Leontief inverted matrix represents domestic input from branch *i* which is directly or indirectly required to respond to a unit change of final demand for *j*.

We applied this basic structure to the rice and cotton value chains in Senegal and obtained the following results by using a disaggregated Social Accounting Matrix (SAM) for Senegal. The basic structure of the Senegalese SAM developed by IFPRI[9] in 2014 was used as a starting point. Assumptions about technical coefficients in the Senegalese rice sector are from Bélières

[9] International Food Policy Research Institute.

and Touré (1999). Likewise, for cotton, we used the product sheets developed by the Banque de Développement du Mali.

The labels in the 'Rice' matrix can be described as follows:

"Water" means water management;

"Inputs" means seed and pesticide purchases;

"Energy": means gas and fuel;

"Other inputs": means purchase of spare parts, repair and maintenance service;

"Paddy" means rice production activity (including labor) and mechanized harvesting;

"Transport": means transportation of paddy;

"Unshelled rice": processing of paddy to (white) rice and packaging;

"By-product": production of rice bran.

The model has several potential applications. As a simulation tool, it allows us to measure the impact of a unit increase in final demand of shelled rice, which is the final output of the chain on intermediate added value, and employment. The impact of a unit variation of final demand on output is shown in the following matrices. Table 1 of the annex gives the inputs-outputs matrix in billions of CFA for rice. Table 2 gives the inputs-output coefficients. Table 3 provides the income multipliers for rice (the inverted Leontief matrix). For cotton, table 4 provides the input-output matrix in billions of CFA, table 5 provides the input-output coefficients, and table 18 provides the multipliers (the inverted Leontief matrix). The total effect of a unit variation in white rice demand on income is 3.161, direct effects are 1.401 and indirect effects are 2.256. Effects on output in each branch are shown in the "rice" column in table 3. Total effect of a unit variation in cotton demand is 2.494 and is broken down into a direct effect (1.554) and an indirect effect (1.606). For labor earnings, the value of multiplier is 60.8 for rice and 13,4 for cotton.

5 Conclusion

In this study, two important value chains are targeted and compared in Benin and Senegal: rice and cotton; which play an important role in both the Beninese and the Senegalese economies. While the rice sector is overwhelming in Senegal, it is relatively marginal in Benin. By contrast cotton is the backbone of the economy in Benin but is negligible in Senegal. Given the strategic importance attached to the production of rice and cotton in Benin and Senegal, forms of rather sophisticated peasant organizations govern the two value chains, while more traditional agricultural practices and level of organization are observed for other agricultural products. These forms of producer organization, which are often an integral part of the state's support mechanisms for these producers, are not necessarily found in the production zones of other speculations. This dualistic approach in state interventions related to the two value chains, as compared to other speculations, yields significant variations in performances, both in the product market and in the labor market.

By all standards, agriculture in West Africa is overwhelmingly informal (Benjamin and Mbaye 2012). And the type of jobs we find therein is mostly vulnerable, being either own-account, or family-based. Therefore, wage-earning accounts for a very small share of employment in rural areas. While this remains true for cotton and rice in Benin and Senegal, households operating in areas where these value chains are organized, seem much better off than their counterparts residing in areas where other speculations are cultivated, and labor patterns are also different in many regards.

The methodological approach we have used is twofold: a) we use survey data when available to compute relational descriptive statistics on the correlation between value chains, labor outcomes, and earnings; b) we use an inputs-outputs (Social Accounting Matrix) approach to compute multiplier effects of value chains on income and jobs. Our results show large discrepancies between value chain areas and the others. Such discrepancies are observed in income generation, and job patterns, as well as socio- -demographic household characteristics. Backward linkages are also significant, since a unit increase in demand for rice brings about a total increase in income amounting to 3.16. This breaks down into a direct effect of 1.40 and an indirect effect of 2.25.

Several weaknesses of the business environment are still hampering value chain expansion. These are mainly: access to financing, lack of training, property rights issues, limited mechanization, and weak access to an affordable and effective source of energy. Policy intervention should aim at removing these bottlenecks to support small and nano-enterprises that are the most prevalent businesses in these areas, and therefore generate less vulnerable jobs.

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Annex 1: Rice simulation

Table A 1: Input-Output Matrix

		ACTIVITIES											
		Water	***Inputs (1)***	***Energy (2)***	***Others inputs (3)***	***Paddy***	***Transport***	***Rice inshelled***	***By-produits***	***Trade***	*Total CI*	*DF**	*Total*
FACTORS AND PRODUCTS	***Water***	2,74				0,38				25,02	28,15	6,16	34,3
	Inputs		10,28			10,35					20,64	3,91	24,55
	Energy	4,58		25,10		20,66	1,85	13,14	3,59	2,38	71,33	6,37	77,7
	Others inputs	1,78		6,28	29,54	1,96	1,49	3,83	0,23		45,13	24,7	69,8
	Paddy					4,016		8,84	0,43	1,72	15,01	46,2	61,2
	Transpt	0,30	0,06	2,36	2,78	0,60	1,80	1,01	0,01		8,95	3,79	12,7
	Rice unsh'd							10,78			10,78	32,89	43,68
	By-products								0,14		0,14	9,85	10,0
	Trade	16,24		2,38		0,29				16,24	35,17	34,91	70,08
value added		**8,656**	**14,198**	**41,569**	**37,547**	**23,003**	**7,603**	**6,052**	**5,580**	**24,712**			
Total		**34,313**	**24,550**	**77,707**	**69,876**	**61,284**	**12,754**	**43,685**	**10,001**	**70,088**			

Source: IFPRI 2014/TOURE and al.1999, authors' calculations.

(1) seed and pesticide purchases (**Inputs**);
(2) energy and fuel (**Energy**);
(3) purchase of spare parts, repair and maintenance service (**Others inputs**)

Table A 2: Input-Output coefficients

	Water	*Inputs*	*Energy*	*Others inputs*	*Paddy*	*Transport*	*Rice inshelled*	*By-produits*	*Trade*
Water	0,080	0,000	0,000	0,000	0,006	0,000	0,000	0,000	0,357
Inputs	0,000	0,419	0,000	0,000	0,169	0,000	0,000	0,000	0,000
Energy	0,134	0,000	0,323	0,000	0,337	0,145	0,301	0,360	0,034
Others inputs	0,052	0,000	0,081	0,423	0,032	0,117	0,088	0,023	0,000
Paddy	0,000	0,000	0,000	0,000	0,066	0,000	0,202	0,043	0,025
Transport	0,009	0,003	0,030	0,040	0,010	0,142	0,023	0,001	0,000
Rice inshelled	0,000	0,000	0,000	0,000	0,000	0,000	0,247	0,000	0,000
By-produits	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,014	0,000
Trade	0,473	0,000	0,031	0,000	0,005	0,000	0,000	0,000	0,232

Table A 3: Matrix of Leontief

	Water	*Inputs*	*Energy*	*Others inputs*	*Paddy*	*Transport*	*Rice inshelled*	*By-produits*	*Trade*
Water	0,920	0,000	0,000	0,000	-0,006	0,000	0,000	0,000	-0,357
Inputs	0,000	0,581	0,000	0,000	-0,169	0,000	0,000	0,000	0,000
Energy	-0,134	0,000	0,677	0,000	-0,337	-0,145	-0,301	-0,360	-0,034
Others inputs	-0,052	0,000	-0,081	0,577	-0,032	-0,117	-0,088	-0,023	0,000
Paddy	0,000	0,000	0,000	0,000	0,934	0,000	-0,202	-0,043	-0,025
Transport	-0,009	-0,003	-0,030	-0,040	-0,010	0,858	-0,023	-0,001	0,000
Rice inshelled	0,000	0,000	0,000	0,000	0,000	0,000	0,753	0,000	0,000
By-produits	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,986	0,000
Trade	-0,473	0,000	-0,031	0,000	-0,005	0,000	0,000	0,000	0,768

Table A 4: Inverse of Leontief Matrix

	Water	*Inputs*	*Energy*	*Others inputs*	*Paddy*	*Transport*	*Rice inshelled*	*By-produits*	*Trade*
Water	1,436	0,000	0,031	0,000	0,024	0,005	0,019	0,012	0,669
Inputs	0,007	1,721	0,001	0,000	0,311	0,000	0,084	0,014	0,013
Energy	0,348	0,001	1,502	0,018	0,549	0,256	0,758	0,573	0,246
Others inputs	0,187	0,001	0,226	1,752	0,147	0,278	0,343	0,131	0,101
Paddy	0,024	0,000	0,002	0,000	1,071	0,000	0,289	0,048	0,045
Transport	0,036	0,005	0,064	0,082	0,040	1,187	0,083	0,029	0,021
Rice inshelled	0,000	0,000	0,000	0,000	0,000	0,000	1,328	0,000	0,000
By-produits	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,014	0,000
Trade	0,899	0,000	0,079	0,001	0,044	0,013	0,044	0,031	1,724

Table A 5: Impact of the increase in final demand for rice (finished hulling)

	Water	*Inputs*	*Energy*	*Others inputs*	*Paddy*	*Trans-port*	*Rice inshelled*	*By-produits*	*Trade*	*Total CI*	*DF**	*Total*	*Total CI*	*DF**	*Total*	*LC*
Water	1,436	0,000	0,031	0,000	0,024	0,005	0,019	0,012	0,669	28,171	6,161	34,332	0,019	0,000	0,019	4,401
Inputs	0,007	1,721	0,001	0,000	0,311	0,000	0,084	0,014	0,013	20,724	3,910	24,634	0,084	0,000	0,084	16,075
Energy	0,348	0,001	1,502	0,018	0,549	0,256	0,758	0,573	0,246	72,093	6,372	78,465	0,758	0,000	0,758	87,209
Others inputs	0,187	0,001	0,226	1,752	0,147	0,278	0,343	0,131	0,101	45,479	24,739	70,219	0,343	0,000	0,343	8,107
Paddy	0,024	0,000	0,002	0,000	1,071	0,000	0,289	0,048	0,045	15,305	46,269	61,573	0,289	0,000	0,289	10,017
Transport	0,036	0,005	0,064	0,082	0,040	1,187	0,083	0,029	0,021	9,040	3,797	12,837	0,083	0,000	0,083	26,084
Rice inshelled	0,000	0,000	0,000	0,000	0,000	0,000	1,328	0,000	0,000	11,117	33,896	45,013	0,328	1,000	1,328	3,993
By-produits	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,014	0,000	0,143	9,858	10,001	0,000	0,000	0,000	7,146
Trade	0,899	0,000	0,079	0,001	0,044	0,013	0,044	0,031	1,724	35,214	34,918	70,131	0,044	0,000	0,044	2,400

Annex 2: Cotton simulation

Table A 6: Input-Output Table for cotton (billion CFA)

	plowing	seeds	other inputs(1)	maintenance	cotton grains	trade	manufacturing	*Total CI*	*DF**	*Total*
plowing	0.333	0.000	0.000	0.000	0.231	0.000	0.000	0.563	0.433	0.996
seeds	0.000	0.017	0.000	0.000	0.012	0.003	0.000	0.032	0.372	0.404
other inputs	0.000	0.000	1.298	0.000	0.901	0.267	0.000	2.467	1.221	3.688
maintenance	0.000	0.000	0.000	0.549	0.381	0.113	0.000	1.043	0.601	1.644
cotton grains	0.000	0.008	0.000	0.000	3.751	0.772	2.288	6.819	7.015	13.834
trade	0.000	0.317	0.267	0.000	1.070	1.541	0.000	3.196	2.578	5.774
manufacturing	0.203	0.038	0.323	0.335	2.288	0.940	3.295	7.422	2.729	10.151
value added	**0.461**	**0.023**	**1.800**	**0.761**	**5.200**	**2.137**	**4.568**			
TOTAL	**0.996**	**0.404**	**3.688**	**1.644**	**13.834**	**5.774**	**10.151**			

Source: IFPRI 2014/TOURE and al.1999

(1): others inputs means pesticides, fertilizer etc.

Table A 7: Input-Output coefficients

	plowing	seeds	other inputs	maintenance	cotton grains	trade	manufacturing
plowing	0.334	0.000	0.000	0.000	0.017	0.000	0.000
seeds	0.000	0.042	0.000	0.000	0.001	0.001	0.000
other inputs	0.000	0.000	0.352	0.000	0.065	0.046	0.000
maintenance	0.000	0.000	0.000	0.334	0.028	0.020	0.000
cotton grains	0.000	0.021	0.000	0.000	0.271	0.134	0.225
trade	0.000	0.785	0.072	0.000	0.077	0.267	0.000
manufacturing	0.204	0.095	0.088	0.204	0.165	0.163	0.325

Table A 8: Multiplier Matrix

	plowing	seeds	other inputs	maintenance	cotton grains	trade	manufacturing
plowing	1.505	0.011	0.003	0.004	0.039	0.010	0.013
seeds	0.000	1.045	0.000	0.000	0.001	0.001	0.000
other inputs	0.017	0.126	1.567	0.017	0.169	0.143	0.056
maintenance	0.007	0.052	0.010	1.508	0.070	0.059	0.023
cotton grains	0.158	0.421	0.116	0.158	1.554	0.410	0.518
trade	0.019	1.176	0.167	0.019	0.182	1.423	0.061
manufacturing	0.501	0.568	0.276	0.501	0.479	0.483	1.641

Table A 9: Impact of the increase in final demand for Cotton

	plowing	seeds	other inputs	Maint-enance	cotton grains	trade	Manu-facturing	*Total CI*	*DF**	*Total*	*Total CI*	*DF**	*Total*	LC
plowing	1,505	0,011	0,003	0,004	0,039	0,010	0,013	0,602	0,433	1,035	0,039	0,000	0,039	0,6
seeds	0,000	1,045	0,000	0,000	0,001	0,001	0,000	0,033	0,372	0,406	0,001	0,000	0,001	0,6
other inputs	0,017	0,126	1,567	0,017	0,169	0,143	0,056	2,636	1,221	3,857	0,169	0,000	0,169	0,6
maintenance	0,007	0,052	0,010	1,508	0,070	0,059	0,023	1,112	0,601	1,714	0,070	0,000	0,070	0,6
cotton grains	0,158	0,421	0,116	0,158	1,554	0,410	0,518	7,373	8,015	15,38	0,554	1,000	1,554	179,6
trade	0,019	1,176	0,167	0,019	0,182	1,423	0,061	3,378	2,578	5,956	0,182	0,000	0,182	0,6
manufacturing	0,501	0,568	0,276	0,501	0,479	0,483	1,641	7,901	2,729	10,63	0,479	0,000	0,479	4,1