

Annex 1

Photograph by P. Casier, CGIAR

Annex 1: The Rice Value Chain

Introduction

Africa has become a major consumer of rice as incomes have improved, the population has urbanized, and more storable, easily prepared foods have come into favor over the traditional grains, roots, and tubers. Despite achievements on the rice supply side (Figure A1.1), sub-Saharan Africa depends heavily on imports from outside the continent. In recent years, imports of milled rice have constituted 45–50 percent of the annual requirement for rice of 18 million tons.

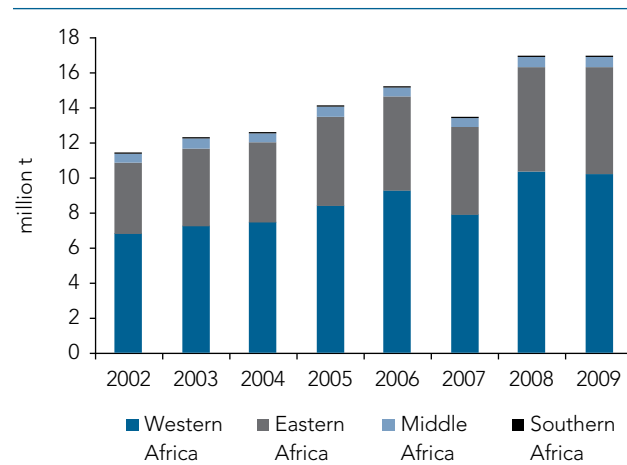
In value terms, rice is the most important basic food imported into sub-Saharan Africa¹ (Figure A1.2).

Annual imports of rice to sub-Saharan Africa now exceed US\$ 4 billion. Here, then, is a substantial market opportunity for a crop that can be cultivated in the many parts of Africa where the climate and soils are appropriate, where increased local production can significantly reduce the foreign currency requirement for imports, and where the establishment of productive capacity can protect the urban consumer from external market price shocks.

Since sub-Saharan Africa continues to import as much as half of its annual rice requirement, it is instructive to review why this situation persists and inquire why local production does not out-compete the imported rice. West Africa, for example, has no single market for rice. Each country has its own national and sometimes local preferences for styles of rice (parboiled, long-grain white, aromatic, japonica), and also for the position of rice in the nutritional balance. While this segmentation gives each market a unique character, there are common themes. Each country depends on imports to supplement its local production. In each one, urban markets drive demand for imports, and local rice has struggled to compete in the home market against the perceived superiority of the imports in terms of variety, quality, and reliability.

As a first step, benchmarking the cost structures in the national rice industries in individual countries against the overseas suppliers should indicate where improvements can be focused

Figure A1.1: Paddy rice production in sub-Saharan Africa



Source: FAOSTAT.

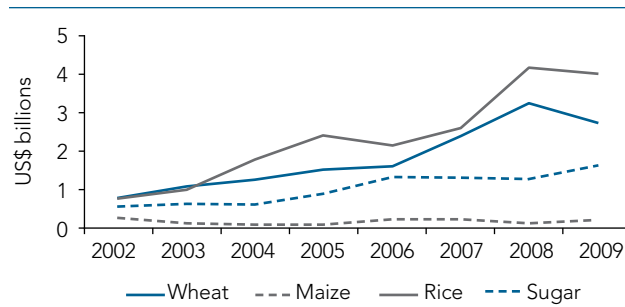
¹ The data exclude rice, wheat, sugar, and maize produced within sub-Saharan Africa and traded regionally. The data here are imports to the continent.

to achieve efficiencies and savings in the African supply chain. This annex describes the survey to benchmark rice value chains in Senegal and Ghana (Table A1.1) against rice value chains of a key supplier, Thailand.

It is important to emphasize that the data summarized here are not drawn from statistically representative samples (that would require a substantially greater input), but the benchmarking tables have been circulated among a number of authorities to validate the assumptions and decisions, and “best guesses” were amended where necessary. Note also that the drivers of consumer choice are not restricted to price (and therefore cost) but include an array of perceptions of visual and organoleptic properties, cooking qualities, and branding.

The exercise should be replicated with appropriate samples to give a clearer picture of inefficiencies and annual variability, which would serve as a key input to planning and support strategies for development. The present analysis attempts to identify what it would take for Ghana and Senegal to become competitive in the international rice market or, specifically, in their domestic rice markets and to exploit the market opportunity.

Figure A1.2: Major food imports to sub-Saharan Africa (value)



Source: UN COMTRADE.

Table A1.1: Rice in Ghana and Senegal

	Ghana		Senegal	
	Rice type: Aromatic and long-grain white (Whole / 5% / 25%) Major suppliers: Thailand, Vietnam, USA		Rice type: Broken (50% aromatic) ^a Major suppliers: Thailand, Vietnam, Brazil	
	2009	Trend	2009	Trend
Production (paddy t)	391,000 ^b	↗	502,000	↗↗
Yield (t/ha)	2.41	↗	3.60	↗
Production (milled equivalent t)	235,000	↗	301,000	↗↗
Imports (milled t)	384,000	↘	769,000	↘
Total usage (milled t)	619,000	↘	1,070,500	↘
Population (millions)	23.8		12.1	
Consumption (kg/head/yr)	26	↘	88.5	↘
% of usage imported	62%	↘	72%	↘
Value of imports (US\$ m CIF)	225	↗	327	↗
Unit value of imports (US\$/t)	585	↗↗	424	↗

Source: Production data from FAOSTAT; trade data from COMTRADE.

^a Trade sources dispute that local production is anywhere near this high.

Current Situation

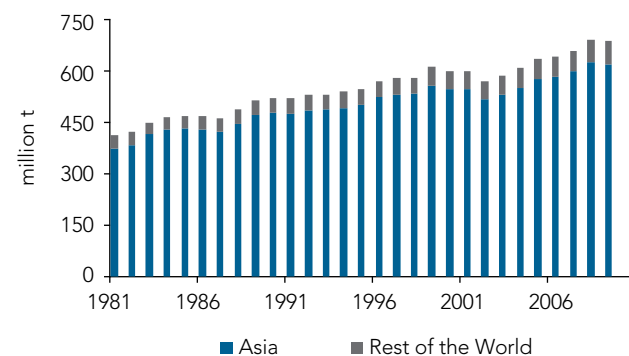
The Global Picture

Worldwide, rice is considered the most important grain crop in human nutrition. In terms of averages of global aggregates, this assertion may be true. Production and consumption of rice are concentrated heavily in the Far East, however, and only 10 percent of global rice output is cultivated outside of Asia. Within Asia, East Asia has long dominated the rankings of rice producers, but latterly, increases in production in South Asia and Southeast Asia have changed the overall picture of the distribution of rice cultivation within Asia as a whole.

World production of rice has risen steadily over the past 30 years (Figure A1.3), owing to an expansion in cultivated area combined with technological development that has improved yields. The adoption of new rice varieties, improved husbandry, and mechanization, along with practices that reduce post-harvest losses, have all contributed to rising yields. Globally, average rice yields have risen to over 4 tons of paddy rice per hectare (Figure A1.4), and all producing regions have shown an increase in land productivity. The pace of yield increases is evidently slowing, but the global picture is heavily weighted to the dominance of the Asian producers and masks continuing yield improvement among smaller producers such as sub-Saharan Africa.

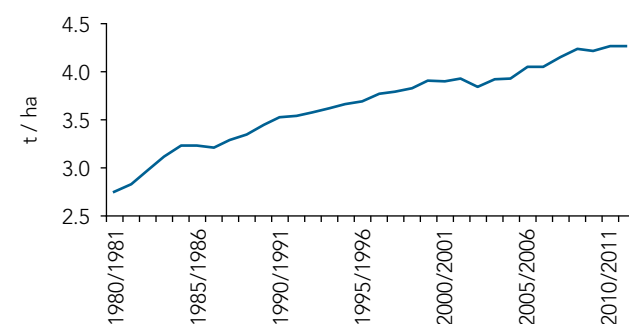
The consumption of rice remains concentrated in Asia. Only 6 percent of the world rice output is exported beyond the national boundaries of the producing country, even though rice consumption is increasing across the world. Increasing consumption is reflected both in the rising output of other regions as well the increasing international trade in rice (Figures A1.5 and A1.6). Four forces guide this progress: population growth, income growth and distribution, the declining real price of rice, and the rural migration of labor to urban employment (Timmer et al. 2009). On the production side, the fastest growth in output by a wide margin has occurred in Africa, where rice cultivation expanded steadily over the past 30 years, initially

Figure A1.3: World production of paddy rice



Source: FAOSTAT.

Figure A1.4: Worldwide paddy rice yield



Source: FAOSTAT.

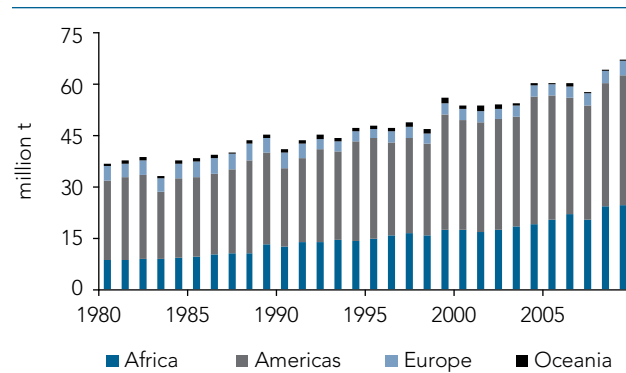
through an increase in area but more recently in impressive growth, albeit from a low starting point, in yields.

The consequence of rapidly expanding consumption and steadier growth in production has been a series of deficits in the annual balance of rice supply and demand. Rising rice yields and area in the 1980s, as a result of the Green Revolution, caused stocks to accumulate and prices to stabilize at a relatively low level. Over the last 10 years, rapid development of demand from nontraditional rice consumers has driven stocks down rapidly (Figure A1.7) and led to a tightness in the market that had been absent for at least 20 years.

Whereas the long-term consumption trend may be impelled by the four forces noted previously, these fundamental drivers were overridden in 2008 by a combination of speculation and fear, which caused governments to restrict exports. The run-up to the infamous 2008 price spike was not reflected in the pricing of rice (Figure A1.8). While rice stocks fell from 2003 through to 2007, prices stayed more or less within a “typical” trading range. A dip in the stock/consumption ratio below 18 percent (around nine weeks’ worth of global usage) coincided with global fears of increased grain consumption and poor grain crops, however. Prices moved to a different level altogether under panic buying that in turn provoked governments to ban exports.

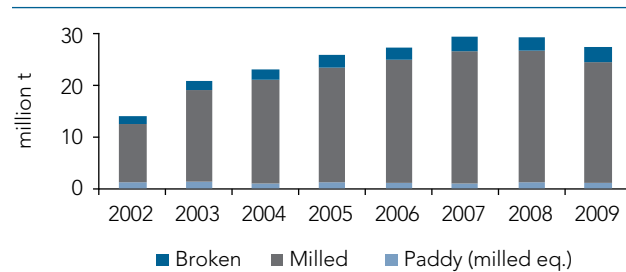
Normal trading conditions have resumed, but only a fragile calm has returned to the markets since 2008. Despite the elapsed time and continued high prices for rice, production has not increased in response to this incentive to permit stocks to return to a more comfortable level (near 35 percent).

Figure A1.5: Production of paddy rice outside Asia



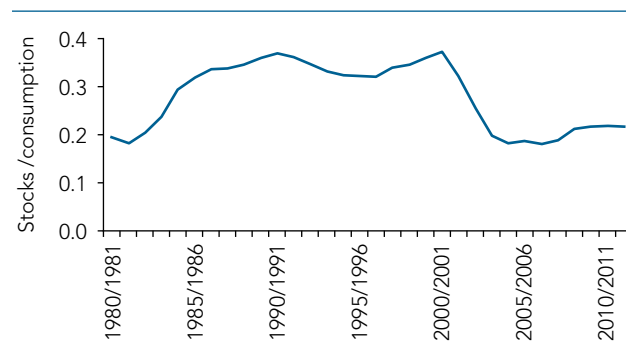
Source: FAOSTAT.

Figure A1.6: World rice exports



Source: COMTRADE.

Figure A1.7: Global stock to consumption ratio for milled rice



Source: USDA.

This result is not surprising; to achieve this restoration will take an additional 12–15 percent of global output, equal to approximately 80–100 million tons of paddy rice. At current yields (FAOSTAT), this quantity of paddy will require the cultivation of at least another 20 million hectares *above* the annual increment needed to meet rising global demand. The land, irrigation, labor, and financial demands to achieve this surplus are enormous, at a time when simply keeping pace with rising consumption is a challenge.

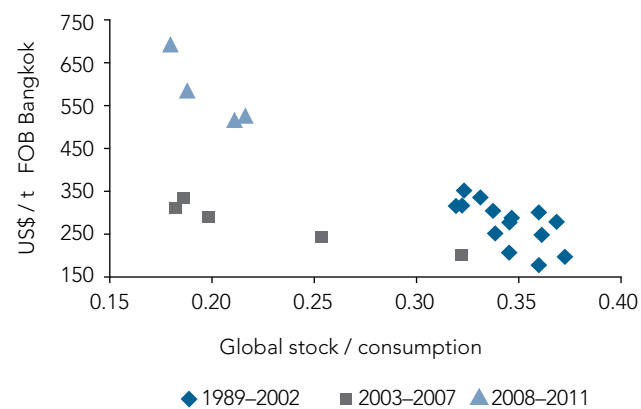
From the African rice importers' point of view, the situation in the short term is particularly dangerous. Not only are stocks low, but international supplies depend on a small number of exporters. Globally, only four rice-producing countries account for 80 percent of the supplies entering international trade (Figure A1.9). Two of them, which provide nearly 60 percent of exports, are in the same region and subject to similar climatic variation. It is self-evident that the only countries that export rice are those that produce more than their annual requirement. So long as 6 percent of the annual global rice crop is available for export, there will be few options and alternatives for sourcing supplies internationally.

Africa

A compilation of international trade data for exports indicates that the rice trade to sub-Saharan Africa has leveled off (Figure A1.10). The steep rise in trade at the turn of the century was one contributor to the mounting deficit in the global rice market at the time. In recent years, however, the trade leveled off, and exports to the continent now account for about 30 percent of global trade in rice. The leveling off of exports to Africa pre-dates the price crisis of 2007/08 and is therefore not a consequence of high prices. More likely a disaggregation of the statistics to the national level would show slackening demand from some larger consumers, such as Nigeria, where growth rates have tailed off.

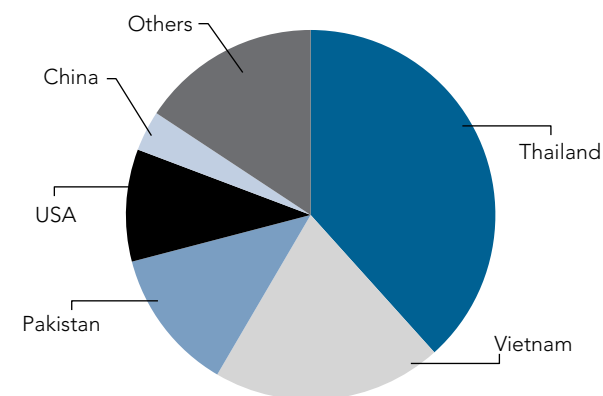
Africa's rice output has increased (Figure A1.11). Two areas in particular

Figure A1.8: Rice price (white rice, Thai 100% B) versus global stock/consumption ratio



Source: USDA data.

Figure A1.9: Exporters of milled rice, 2008 (total: 22.61 million t)



Source: COMTRADE data.

now lead rice production in Africa: the northern Maghreb countries and West Africa. Among the northern producers, Egypt dominates and obtains some of the world's highest rice yields (in excess of 9 tons per hectare in 2001). Egypt is a rice exporter. Most of its production is based on japonica rice, which is well suited to the Mediterranean climate.

Within West Africa, the status of rice varies from country to country and even within countries. For some it is a staple (Guinea, Senegal), for others it is a supplement, and for others an urban luxury. West Africa's rice production has increased steadily over the past 20 years, and FAO now estimate production at over 10 million tons of paddy rice per year. The three largest producers—Nigeria, Guinea, and Mali—together account for some 66 percent of the regional total. Meanwhile consumption has reached the equivalent of almost 14 million tons per year of paddy rice, and the shortfall is provided by imports of milled rice. Here, however, the data become unreliable, and some disagreement arises as to the extent of the deficit.

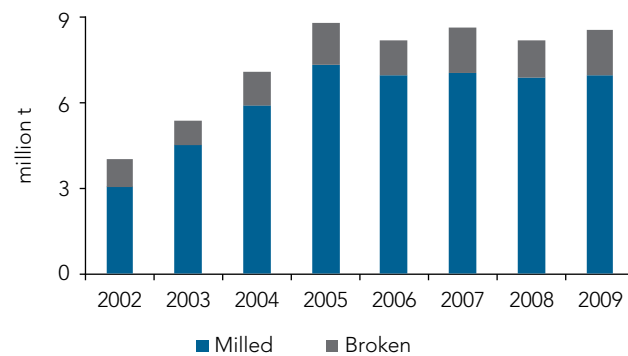
Country Overviews

Thailand

Thailand is only the fifth largest rice-producing country, with an annual output of about 20 million tons of milled rice, but Thailand has long been the largest exporter. The Thai Rice Exporters' Association estimates Thailand exported 9.03 million tons of rice in 2010, valued at US\$ 5.3 billion. Despite the recent floods and government intervention in purchasing, which prices the production out of the market, FAO has forecast Thai rice exports to reach 10.6 million tons in 2011.

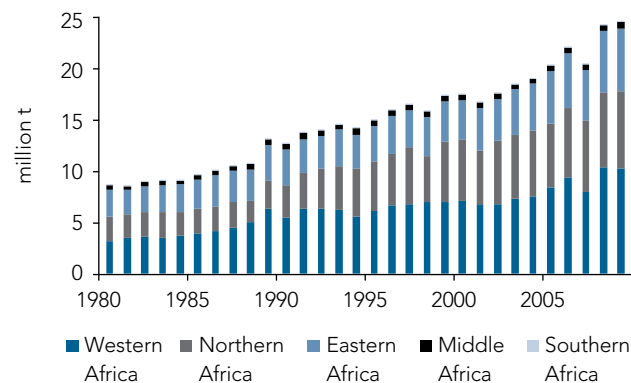
Bumper crops are expected in a number of other rice-producing countries. Vietnam, Thailand's closest rival in the international rice trade, exported an estimated 6.9 million tons in 2011 and is becoming increasingly competitive in terms of production volume for export. (Figure A1.12).

Figure A1.10: Rice exports to sub-Saharan Africa



Source: UN COMTRADE data.

Figure A1.11: Production of paddy rice in Africa



Source: FAOSTAT.

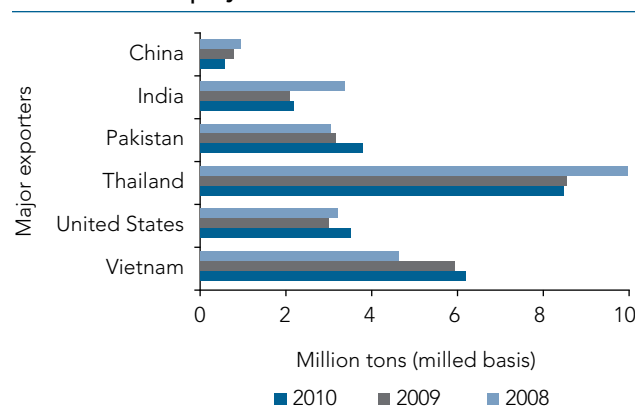
Today, Thailand faces challenges to remain competitive, including yield stagnation, diminishing natural resources, inadequate infrastructure, and more sophisticated and varied demand. How Thailand responds to these challenges will significantly affect market competitiveness and the global rice trade.

Thai white rice and parboiled rice are the major categories of rice exported by volume (Figure A1.13). The Thai Jasmine rice, Hom Mali, is significant in terms of its high market value. To move away from producing commodity rice, for which Thailand is uncompetitive in price, the Thai industry developed Hom Mali as a brand. The cultivation of Hom Mali is restricted to northeastern Thailand by its photosensitivity and ecological requirements. A specific logo marks the product as Hom Mali or as “Jasmine,” and the contents of the package must be at least 92 percent Hom Mali. An alternative fragrant rice variety, Pathumthani 1, is now quite widely grown in the Central Region of Thailand. It is not photosensitive but requires more inputs, especially insecticides.

Nevertheless, yields of Pathumthani 1 (4.0–4.8 t/ha) are substantially higher than Hom Mali (less than 2.5 t/ha), and production costs are lower. Pathumthani is widely used in Thailand as a fragrant rice of lesser quality than Hom Mali but still quite acceptable. It can be marketed as “Fragrant” rice (in blends of up to 80 percent Pathumthani and 20 percent white rice), and its exports have increased by around 14 percent during 2011.

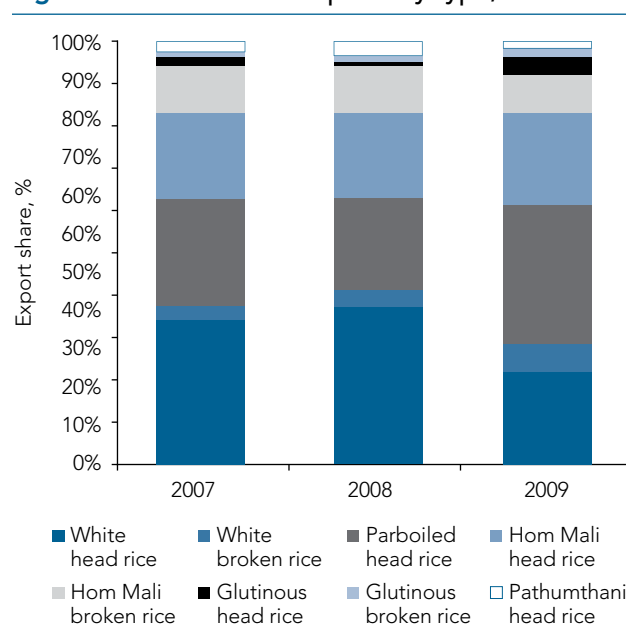
Africa is the major destination for Thai exports (Figure A1.14); the leading African importers are Niger, Côte d’Ivoire, South Africa, and Benin. Exports to Senegal have fallen away (from 680,000 tons in 2007 to 275,000 tons in 2010) as the market has shifted to lower-priced rice from other producers. Imports to Ghana have fallen off, too, from 2007 (225,000 tons) to

Figure A1.12: Rice exports by the six major global players



Source: FAOSTAT.

Figure A1.13: Thai rice exports by type, 2007–09



Source: Thai Ministry of Commerce 2009.

2010 (120,000 tons). The Ghana figure probably understates the real level of imports, however, because of the cross-border trade from Côte d'Ivoire where import duties are lower.

Production

Agricultural land occupies 38.5 percent of the land area in Thailand, but agriculture has contributed only 9–12 percent of annual GDP since 2000. Key economic indicators show a fluctuating annual GDP growth (7.8 percent in 2010) but relatively stable contributions to GDP by the two main sectors, industry (44–45 percent) and services/tourism (43–45 percent).

Rice production and exports form the dominant part of agriculture in Thailand, although the area devoted to rice increased only gradually over time and was estimated at 10.6 million hectares in 2010 (Figure A1.14).

Rice cultivation is concentrated in two broad regions of Thailand (Figure A1.15 and Table A1.2). Overall, Thai rice cultivation can be classified according to four major agro-ecological zones: irrigated, rainfed lowland, deepwater, and upland.

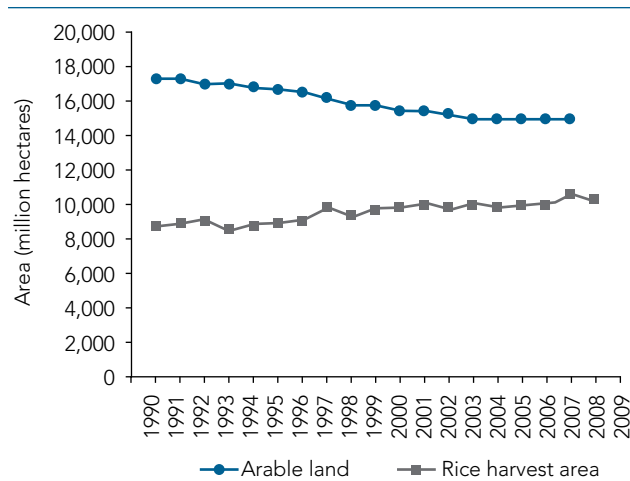
Irrigated. The irrigated ecology is the most favorable environment for rice production. The importance of the irrigated ecosystem in Thailand is the certainty of increased rice production in both the wet (main) season and dry (second) season. Farmers in the most favorable areas can harvest five crops within two years. Irrigation is concentrated in the Central Plain and lower North, where the bulk of Thai white, nonaromatic rice is produced. About 23 percent of the main-season crop is irrigated compared to 77 percent of the second crop.

Production constraints in irrigated rice are generally unrelated to climate, although the uncertainty and scarcity of irrigation water in extremely dry seasons can be a most important constraint. Most constraints are related to biotic factors, however, especially diseases (blast, ragged stunt) and insects (brown planthopper).

Most irrigated rice areas are planted to several high-yielding varieties, such as Chainat 1 (the most popular), Suphanburi 60, Suphanburi 90, RD23, RD10, RD15, Suphanburi 1, and Suphanburi 2. These varieties can yield as much as 6–8 t/ha, but yield gaps remain high in irrigated ecologies, especially in the wet season, due mainly to limited irrigation water, low inputs used, and crop losses caused by diseases, insects, and pests. Even so, it is still possible to narrow yield gaps in the irrigated ecology.

Rainfed lowlands. Rainfed lowlands account for approximately 75 percent of the wet season rice area and 68 percent of production. They are the predominant rice ecology in Thailand, but

Figure A1.14: Arable land and rice harvested area, Thailand



Source: IRRI/FAO.

average yields realized in this ecology are extremely low at about 2 tons per hectare, leaving much room for improvement.

Farmers grow improved traditional and local varieties; the precise varieties vary among locations. These varieties are mostly photoperiod sensitive. At about 4.5–6 tons per hectare, their yield potential is generally low, but they have better grain quality and characteristics than the high-yielding varieties grown under irrigation. The most common popular variety currently grown in the rainfed lowland areas is Khao Dawk Mali 105.

Major production constraints are the variable rainfall, drought, submergence, and inherent low soil fertility, especially in the Northeast. Infrastructure at the farm level in most rainfed lowland rice areas is very poor and cannot support a high level of rice production.

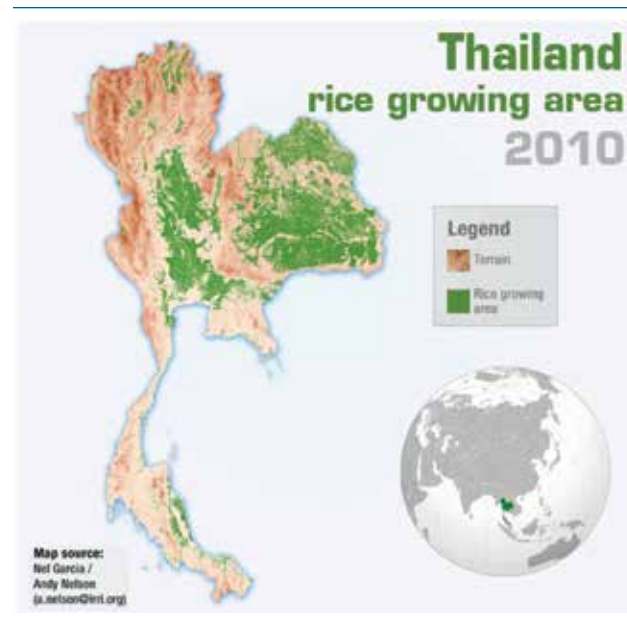
Deepwater (submergence tolerant). Vast rice-growing areas in the Central Plain of Thailand are subject to long periods of deep flooding annually. Although about 0.82 million hectares of rice were planted to floating rice varieties in the 1972/73 crop year, recent changes in this rice ecology have resulted from land modifications, infrastructure development, and flood control, and the area planted to deepwater rice has fallen. Harvested deepwater area was estimated at about 0.81 million hectares (9.77 percent of the wet season rice area) in 1977/78 and only 0.16 million hectares (1.92 percent of the wet season rice area) in 1997/98. Production from the deepwater ecosystem is relatively small; it was approximately 0.31 million tons in the 1997/98 crop year. The average yield is generally low, at about 1.95 tons per hectare.

Varieties used in this ecosystem are mostly local and traditional improved varieties. Their yield potential is generally low (3–4 tons per hectare), although varieties under development have a yield potential of about 4–5 tons per hectare. The yield gap in the deepwater ecosystem is generally small.

Drought in the crop's early vegetative phase, long-term deep flooding in the late vegetative to early ripening phases, and weed competition are the most important production constraints in the deepwater ecosystem. Very abnormal deep flooding sometimes causes serious yield losses, however.

Upland. In terms of area, upland rice is Thailand's smallest rice ecology and is declining. Yields are low, often about 2–3 tons per hectare, and the yield gap is small. Drought, poor soil fertility, and weed competition are the most important production constraints.

Figure A1.15: Rice cultivation in the Central Plain, Lower North, and Northeast



Source: IRRI.

Table A1.2: Production systems and cropping practices

	Region	
	Lowland Central Plain and lower North along the main rivers	Upland Khorat Plateau in the Northeast
System	Intensive, irrigated	Less intensive, rainfed
Mechanization	Mostly fully mechanized	Partial mechanization
Rice varieties	White rice: Chainat 1 Suphanburi 1, 2, 60, and 90 Nonphotosensitive aromatic: Pathumthani 1	Aromatic: Khao Hom Mali [KDML 105] Glutinous varieties: RD6 Older, traditional varieties
Crops	From 2 per year to 5 in 2 years	Mostly 1 per year
Harvested area	Central + Northern Wet season: 2,852,170 ha Dry season: 2,036,868 ha	Wet season: 5,007,931 ha Dry season: 273,693 ha
Yields (paddy)	Wet season: 4.25 t/ha Central 3.37 t/ha Northern Dry season: 4.95 t/ha Central 4.18 t/ha Northern	Wet season: 2.11 t/ha Dry Season: 3.21 t/ha
Mean farm size (wet season)	4.4 ha (Central)	2.3 ha

Source: Office of Agricultural Economics.

Land

Thailand has a total land area of 510,890 square kilometers, of which 38 percent is classified as agricultural and 28 percent is irrigated. Of the total population of 67.3 million (2008), 67 percent live in rural areas; 42 percent of the working population engages in agriculture. Total agricultural holdings number about 5.7 million on 19 million hectares. About 3.9 million holdings are planted to rice. The total harvested area for rice is 10.3 million hectares, and the total paddy yield is 31.8 million tons. At the producer level, Thailand has 16.2 million people (or 3.7 million households) engaged in rice farming. The average farm size by region is shown in Table A1.3.

Thailand's efficient, transparent land administration system has become a model for other countries.² It has issued title deeds to large portions of the country's population, thus contributing to tenure security and developing a robust land market. The system was initiated by the government

Table A1.3: Average size of rice farms in Thailand

Season	Average farm size (ha) by region				
	Central Plain	North	Northeast	South	Countrywide
Wet	4.4	2.3	2.3	1.9	2.5
Dry	4.8	4.6	2.4	2.3	4.1

Source: Office of Agricultural Economics 2010.

² See <http://usaidlandtenure.net/usaidltpproducts/country-profiles/thailand> for details.

in the 1970s through several legislative and programmatic efforts to address high levels of tenancy, landlessness, and tenure insecurity. Thailand recognizes three types of tenure:

1. *Ownership.* Landowners have freehold rights to exclusive use and possession of their land. Land held in ownership can be freely transferred and mortgaged. About 71 percent of Thailand's agricultural land is held in private ownership.
2. *Leasehold.* Both private and public land can be leased. Leasehold terms may be up to 30 years and leases over 3 years must be registered. Between 11 percent and 30 percent of agricultural land is under some form of tenancy. About 25 percent of agricultural land in the Central Region is leased.
3. *Occupancy and use rights.* These rights take several forms. Holders of land exploitation or land use certificates can use, possess, transfer, and sell their land. The holders can mortgage the land and can apply for freehold title. Certificates of Right to Farm are granted to beneficiaries of land allocations. The right to transfer is limited to inheritance.

With the support of the World Bank and AusAid, Thailand conducted a land-administration modernization and titling program from 1984 to 2004. The Land Titling Program issued freehold title deeds to eligible landowners who possessed no documents or possessed only preliminary documents. The program also converted the Certificates of Use and the Exploitation Certificates held by some landholders into title deeds.

Roughly 63 percent of the country's 30 million parcels of land are registered, and nearly 90 percent of land transactions are registered. On average, land registration procedures require less than a day and cost about 1 percent of the property's value. Registered land rights in Thailand are considered secure.

Thailand's formal law promotes principles of equality and does not support the dominance of either men or women in owning or controlling land. All land transactions require spousal approval and signature. Formal inheritance law does not distinguish between men and women. When a person dies intestate, his or her spouse inherits first, followed by children, who inherit equally.

The Department of Lands (within the Ministry of the Interior) is responsible for land administration in Thailand and operates through a system of provincial and district land offices. The department is responsible for registering landholdings, issuing land titles and land use certificates, and conducting cadastral surveys. The Department of Public Welfare, also within the Ministry of the Interior, implements land settlement projects that allocate public land to farmers and poor families as part of the social welfare program.

Depending on the location and services, land can be expensive. Farmers in the Central Plains quoted figures around of 100,000–150,000 baht (THB) (equivalent to US\$ 3,333–5,000) per rai.³

For the most part, land in the Central Region is titled and there is a market for it. Where there is reasonable access to paid employment, for example nearer to Bangkok, small farms can be managed in conjunction with a regular job. A small holding may provide only a meager income in more rural areas remote from urban employment opportunities, even if yields are good, and there is a strong incentive to sell the land. Government sources indicate that the number of rice-farming

³ Or US\$ 20,000–30,000 per hectare; THB 30 = US\$ 1.



families is indeed declining. While rice remains a small-scale activity, larger farms do exist. One farmer interviewed cultivated 100 rai (16 hectares) of rice, but this amount of land is still considered unusually large for Thailand.

Water management

The first attempt to provide a modern irrigation system in the country started when Thailand began to increase its rice exports some 100 years ago. The first water resources development with a large irrigation system was a water conservation scheme in the lower Chao Phraya river basin in the Central Plain in 1896. In 1915, the first large-scale gravity irrigation project, covering 108,800 hectares, was built on the Pasak River on the upper Central Plain.

The Northern Region began to install modern irrigation systems in 1930; the Northeast in 1938; and the Southern Region only in 1948. By 2000, public irrigation schemes in Thailand covered about 4.98 million hectares, comprising about 2.23 million hectares in Central Region, 1.32 million hectares in the Northern Region, 0.84 million hectares in the Northeast, and 0.82 million hectares in the South.

As of 2005, Thailand had about 6.08 million hectares of irrigable area (about 65.78 percent of its major rice planting area), of which about 3.70 million hectares were served by large- and medium-scale irrigation projects. About 71 percent of large- and medium-scale water management and irrigation schemes serve the Central Plain and Northern Regions, where most lowland production of irrigated, high-yielding white rice is concentrated.

Data from the Thai Office of Agricultural Economics for rice production under irrigation from 2007 to 2009 show that 26.3 percent of the rice area is irrigated in the main (rainy) season (representing 36.2 percent of total paddy production) and 77.2 percent in the second (dry) season (78.3 percent of total paddy production) (Table A1.4).

The Northeastern Plateau remains largely rainfed, with only 17 percent of farmland under irrigation by medium- and small-scale facilities. Older traditional varieties, glutinous rice, and the economically important Khao Hom Mali (KDML 105) predominate.

Data from the Royal Thai Irrigation Department⁴ from 2005 indicate that 85 large-scale irrigation projects were constructed under its auspices, for an irrigable area of about 2.69 million hectares.

Table A1.4: Distribution of irrigated rice area and production

		2007		2008		2009	
		Main	Second	Main	Second	Main	Second
Households (no.)		3,700,529	476,504	3,715,324	483,025	3,711,478	475,521
Harvested area (million ha)	Irrigated	2.39	1.59	2.44	1.51	3.41	1.49
	Unirrigated	6.78	0.45	6.74	0.47	6.75	0.44
Production (million t)	Irrigated	7.95	6.97	8.16	6.55	8.29	6.51
	Unirrigated	15.36	1.82	15.08	1.87	14.68	1.80

Source: Office of Agricultural Economics 2010.

⁴ See www.rid.go.th/eng/index/html.

The area under large-scale projects has not increased significantly in recent years. Few sites are suitable for dam construction, and such projects face restrictions from environmental conservation bodies and conflicts of opinion with NGOs.

The irrigation department had completed 747 medium-scale irrigation projects by 2005, which covered an irrigable area of about 1.14 million hectares, with a total water storage capacity of 3,500 cubic hectometers. Major water uses for agriculture, industry, and public water supply rely mostly on the large- and medium-scale projects. Approximately 10,060 small-scale irrigation projects cover an irrigable area of about 1.55 million hectares, with a storage capacity of about 1,547 cubic hectometers.

In addition to the three main types of irrigation project, many special small-scale electric pumping irrigation projects are built along the main rivers. One station can cover an irrigable area of about 500 hectares. Farmers contribute their own land and manage the facilities themselves. It is key to note that as with other types of irrigation in Thailand, the water supply itself is free.

The participation of water users is vital for the efficiency and sustainability of water management and the maintenance of irrigation facilities. The irrigation department organizes water users' groups in each village service unit. These groups form registered organizations such as water users' cooperatives or water users' associations. Common water management practices are equitable rotational irrigation using irrigation canals and ditches and maintenance of water gates and boundary bunds.

In Thailand, the formation of water users' organizations (WUOs) was originally initiated by the government during construction or after completion of irrigation projects in accordance with government policy. There are formal and informal WUOs. Water users' cooperatives and water users' associations are classified as formal organizations, while water users' groups and water administration groups operate informally.

At present no specific laws govern WUOs. The average size of a water users' group varies widely, from about 40–80 hectares, and most such groups have a membership of 20–30 farmers. Membership is voluntary, and no legal sanctions are taken with nonperforming members.

WUOs are now established during the implementation of on-farm irrigation facilities and now cover about 27 percent of the large- and medium-scale irrigation project area in the country. The establishment of WUOs prior to the initial delivery of irrigation water enables the WUOs to begin educating water users in new water management and irrigated farming methods in advance of the actual implementation of the new system.

Generally, the success of water management in irrigation projects depends on the active participation of individual water user or members of WUOs. It has been revealed that most WUOs do not operate efficiently because they lack active local leadership, are weak in administration and management, and lack sufficient incentive without there being any specific laws concerning WUOs.

Seed supply

Thailand requires about 1 million tons of rice seed per year. This potential market is valued at US\$ 380 million in sales. Government agencies have the capacity to produce only 10 percent of the required seed supply. Local seed producers and progressive farmers contribute another 100,000 tons. Private industry and seed retained by farmers for the following season make up the rest of the supply.



Thailand has a long history of organized rice research. The first variety contest took place in 1907, and a rice research station was established in 1916. Since the late 1990s, the Bureau of Rice Research and Development in Bangkok acts as the umbrella organization and includes agricultural universities, research institutes, and 27 Rice Research Centres spread throughout growing areas. Basic breeding material comprising over 24,000 germplasm accessions and breeding lines is held in the National Rice Gene Bank at the Pathumthani Rice Research Centre north of Bangkok. Conventional rice breeding research has tended to fall behind more advanced research on biotechnology and the rice genome owing to limited funding and numbers of scientists trained in such research.

As indicated, Thailand has released a range of recommended varieties for irrigated, rainfed, and deepwater ecosystems. Seed is distributed through the Bureau of Rice Seed's 23 Rice Seed Centres and the Department of Agricultural Extension, which carries out seed multiplication and organizes demonstration plots at the district and local level. Farmers are often skeptical of government advice and prefer to carry out hands-on testing before deciding to adopt a new variety. Seed is sold at close to the current market rate (THB 18–20 per kilogram).

Licensing of new rice varieties is strictly controlled under the 1999 Plant Varieties Act and must be examined and approved by the Bureau of Rice Research and Development after multi-location testing for varietal stability. The introduction of exotic rice varieties as breeding material is permitted, but genetically modified varieties are still totally prohibited. Authorities are concerned to avoid the introduction of exotic diseases, the degeneration of local germplasm, and genetic adulteration of indigenous Thai varieties.

R&D for hybrid rice, highly successful in other countries such as China, began only recently. The Thai Seed Trade Association (THASTA), together with some multinational seed suppliers, seeks to get the authorities to relax the associated regulations. The association has joined other agencies and private companies to conduct field research on six locally developed hybrid rice strains at a number of locations. Hybrid rice seed is priced at least five times higher than conventional seed, but the seeding rate is lower (15 kilograms per rai versus 20 kilograms per rai for conventional seed), and yields can surpass 1 ton per rai (6.25 tons per hectare) for lowland long-grain white rice. Multinationals such as Monsanto, Syngenta, Bayer, Pioneer, and Pacific Seeds are well established in Thailand and produce improved hybrid seed of a range of field and vegetable crops both for export and the local market. The Crop Integration Division of the Thai Charoen Pokphand (CP) group also provides improved seeds as part of its package to farmers.

Chemical inputs

High inorganic fertilizer application rates are a characteristic of rice cultivation in Thailand. From 2000 to 2008, application rates increased from 1.98 million tons to an estimated 2.64 million tons.

A wide range of compound fertilizers is available nationwide, but costs are relatively high. Basic ingredients for fertilizer are all imported and are then mixed and blended within the country. Imports of urea alone were 2.5 million tons in 2009. Total imports of chemical fertilizer rose to 5.2 million tons in 2010. Few subsidies exist for farmers to purchase fertilizers, despite their high costs. The Marketing Organisation for Farmers and the Bank for Agriculture and Agricultural Cooperatives (BAAC) have offered subsidized prices through government channels but can supply only



20 percent of demand. The majority of fertilizer is still sourced from the private sector, and prices are subject to free market forces.

Plans for subsidies and the dissemination of guidelines on reducing fertilizer application rates were drawn up by the previous government but were not implemented prior to the latest change in administration. At the time, experts doubted whether the government would be able to reach its goal, since many fertilizer and pesticide businesses are in the hands of provincial and national politicians.

The campaign was part of a government project to provide cheaper fertilizers, with a subsidy of US\$ 50 per ton to reduce growers' costs. Fertilizer accounts for 30–40 percent of production costs.

In Northeast Thailand, insecticides and fungicides are rarely used. In the Central Plains, however, their application is a key component of rice husbandry. The brown planthopper (*Nilaparvata lugens*) in particular can devastate large areas. Infestations are believed to be worsening because high rice prices have encouraged continuous and dense rice cultivation. Integrated pest management protocols are being investigated to reduce the dependence on chemical pesticides. Herbicides are rarely used.

Mechanization

Thailand's first five-year plan, covering 1961–66, aimed to raise the standard of living by means of greater agricultural, industrial, and power production. The second development plan (1967–71) emphasized agricultural development, highways, irrigation, education, and industrial development in the private sector. The third development plan (1972–76) focused on improvements in rural infrastructure, growth in the financial and commercial sectors, and further assistance to crop diversification and to import-substitution industries. The first three plans did much to increase the standard of living and bring new roads, irrigation schemes, and land reform to the prosperous Bangkok region. But these changes also increased the income gap between rural and urban Thailand and drew increasing numbers of migrants to the city in search of work. The migration of labor from the agricultural sector to other sectors has continuously increased, and mechanization has become one of the important inputs for modern Thai agricultural production systems.

The development of farm mechanization in Thailand started with small-scale machines such as irrigation pumps, power tillers, and threshers. Most farm machinery is manufactured locally, except for the more robust four-wheel tractors, which are imported, and many are second-hand units. Such machinery has enabled farmers to grow more than one crop a year. The use and types of mechanization are expanding. Increases in the use of power tillers, irrigation pumps, and power threshers have been quite stable, but the use of rice combine harvesters has been increasing rapidly. Equipment such as automatic rice seedling transplanters is now being imported and adopted by wealthier farmers growing rice under irrigation in the Central Region.

The unique, long-handled “Thai” two-wheel tractor (the “iron buffalo” walking tractor) was developed in the late 1950s by the Engineering Division of the Thai Rice Department of the Thai Ministry of Agriculture and Cooperatives. The long handles were made for turning the tractor more easily in wet rice fields. Initially, the tractor had no differential or steering clutches, and the engines were kerosene-pumping engines. As the popularity of the tractor became obvious, Japanese firms set up diesel engine factories in Thailand with agreements to progressively increase the local content of their products, which are now nearly 100 percent Thai manufactured. Kubota,⁵ established



in Thailand in 1977, is the predominant firm. Just as the company had made Japanese rice cultivation more efficient in the 1950s, its agricultural machinery division sought to customize equipment for indigenous agricultural conditions wherever it competed in foreign countries. The tractor was made by many local workshops—each copying from the others—and competing for sales to the point that the tractor without an engine was very inexpensive, about one-third to one-half the cost of the engine. Attachments were moldboard and disc plows, harrows, trailed type rotary puddlers (lateral drums with protruding paddles), and trailers. The tractor eventually evolved into a more complex standard model with three gears forward, one reverse, and steering clutches.

Until recently (2010) the Thai models had no power take-off (PTO), but many farmers used v-belts to connect the stationary tractor engine to power water pumps and other equipment. A new NC Plus model offered by Siam Kubota now comes with a PTO and rotary tiller. The tractors are still made by several Thai companies, but recently inexpensive, Chinese-made NC models have come onto the market. Through the 1980s and 1990s, more than 50,000 tractors were reportedly produced and sold each year. According to FAO (2008) about 2.2 million two-wheel tractors and 48,000 rice combine harvesters are in use.

Commercialization

There are three routes for marketing harvested rice:

1. *Directly to the mill.* The combine harvester loads directly from the field into a truck that then delivers to the mill. The choice of mill (contract farming seems rare) is agreed between the farmer and truck driver.
2. *Through a consolidator.* The rice may be sold through a consolidator who assembles quantity before delivering to a mill. The margin here is reportedly about 3 percent (US\$ 10–15 per ton).
3. *Through cooperatives.* Rice may be sold through the Agricultural Marketing Cooperatives. About 10 percent of the crop is traded this way.

Thailand has an excellent network of paved roads, and transport is inexpensive; transport costs are around US\$ 0.05 per ton-kilometer for longer distances. Short-haul transport will be more expensive to allow for proportionately more time loading and unloading. Hom Mali may be brought down from the Northeastern Region to mills in the Central Region.

The farmers are paid immediately or within two weeks. The rice is sold at a moisture content of at least 22 percent, as there are scant facilities for drying and storing rice in rural areas. The mills impose a discount of THB 110 per ton per 1 percent moisture point, with 15 percent being the standard purchase price. Aside from the variety concerned, there seem to be no other quality considerations in the transaction.

The key issue in the commercialization link of the value chain is government intervention. This issue is discussed under “institutional support” later in this section.

⁵ See <http://www.kubota-global.net/>.



Financing

The Thai government established the BAAC in 1966 as a state enterprise under the jurisdiction of the Ministry of Finance.⁶ Rice loans are by far the largest crop in the BAAC portfolio: In 2009 loans to rice farmers amounted to THB 73 billion (US\$ 2.43 billion), and of these, over 80 percent were made to individuals.

The BAAC has 4.5 million direct clients and estimates that a further 16 million families are indirect clients; together they equate to 98 percent of farming families. Only the largest farmers will go to commercial banks for loans. On average loans are repaid in six to eight months; in 2010 the delinquency rate was around 6.5 percent.

Credit is available at favorable rates and on terms up to 15 years. Collateral is not always required, and the BAAC will accept either group lending schemes or guarantors. Interest rates vary but in rural areas lie between 7 percent and 9.5 percent (current inflation is around 4.2 percent).

Weather index insurance is being established for rice. Currently over 4,000 families have insurance.

Mills and exporters use the commercial banks. Interest rates are negotiable from the standard 6 percent downwards. For exporters, financing is on a three-month cycle from purchasing from the mills, through cleaning, packing, and shipping.

Milling

The Thai Rice Millers' Association⁷ estimates that milling capacity is around 120 million tons per year of paddy, whereas output is just over 30 million tons of paddy. Milling costs are of the order of THB 1,000 per ton, which would include a margin of around 2–3 percent for the miller.

An often-quoted statistic refers to 40,000 rice mills in the country. The Thai Rice Millers' Association reports 20 core members who are most active and a membership of several hundred. Some of the overcapacity is generated from the seasonality of Hom Mali, which must be processed after harvest, when mills operate at 100 percent capacity.

Individual mills range in scale from artisanal, village-level mills to those with a capacity in excess of 200,000 tons of paddy rice per year. A large number of mills are outdated and running well below capacity. Meanwhile, at the top end of the sector, there was much investment in 2007 and 2008, when the mills benefited from free financing from the Thaksin Shinawatra government as well as high rice prices on the international market. New machinery was installed with a likely gain in efficiency.

Along with capital investment some (probably 20–30) mills have invested in developing internationally recognized standards such as HACCP, British Retail Consortium Global Standards, and ISO, among others. Certification is comparatively rare and depends on the end market. It indicates a belated shift in thinking from commodity handling to food processing, which can be seen in mills packaging rice in consumer packs for domestic and overseas markets. HACCP requires a certain level of traceability and will have an impact on the relationship between the farmers and the mills in the future.

The overall impression is of a milling sector that is likely to go through some significant consolidation in the next 10 years. The overcapacity is unsustainable; those who have invested in new

⁶ See <http://www.baac.or.th>. It replaced the Bank for Cooperatives established in 1947.

⁷ See <http://www.thairicemillers.com/>.



and efficient machinery and in developing standards are more likely to survive in the competitive rice trade, particularly given that some millers seem well capitalized. Further, there is some consolidation along the value chain. Some mills now sell directly to foreign importers rather than through the traditional route (via exporters and possibly traders), and they can capture some of that margin. Equally there may be backward integration, with exporters buying into mills.

Distribution

Rice exporting operations historically grew out of the family mills established two generations ago, which sought to develop the foreign trade in rice once a surplus was available. As exports grew, some companies shed their milling backgrounds to focus on trading. With good connections in the Far East markets, particularly China, the export trade developed, and with the intervention of international brokers, it eventually reached more distant markets. Alternatively, international traders provided a market for FOB sales.

Currently, the Thai Rice Exporters Association lists almost 200 members, although only about 50 companies are continuously active, with 30 accounting for 80 percent of the 10 million tons of exports from Thailand per year. The association, founded in 1918, remains active in regulating and promoting the rice trade as well as supplying members with market information.

Traditionally, exporters take delivery of rice from millers in big bags (1 ton) or in bulk, and they reprocess it for export (cleaning, sorting, sieving, and bagging). They will also blend proportions of broken and whole rice to achieve the required grades. The rebagged rice, which is increasingly packed in smaller bags than the traditional 50-kilogram bags, is dispatched for loading either as break bulk in bags in the hold of a vessel or stuffed in 20-foot containers. Many exporters located themselves on the Chao Phraya River or its tributaries or other waterways leading to the Gulf of Thailand. The rice could be loaded into barges and shipped to the vessels at the mouth of the river. Today, barges may carry up to 1,500 tons in bags, carrying the rice to the ports of Laem Chabang or Ko Si Chang on the east shore of the Gulf. In those ports, bags are loaded by slings directly onto the vessel. There may be difficulties with loading rice in the rainy season, and barges can be in short supply, but generally the rice export process appears constant and efficient.

The exporters may have their own mills (Asia Golden has 16) or buy from mills through a network of brokers working on a 0.75–1 percent commission. The role of the brokers is possibly declining as larger mills are emerging. One of the top five exporters spoke of now buying 50 percent direct and 50 percent through brokers. Again there are signs of consolidation in the value chain.

Some in the exporter sector are beginning to move up in the value chain. Further changes are seen among the mills; as mentioned, the larger mills now have their own capability to produce a finished product that is cleaned, sieved, sorted, and bagged for retail. This capacity is still relatively unusual, however, and it is likely that most mills prefer to remain as mills for the present and concentrate on their core business. Since the bulk of the export trade is with Asia, and a certain amount is government to government, the overall pattern may not change. Looking specifically at Africa, however, some consolidation is evident in the chain, with some African buyers now sourcing direct. The development of container capabilities in Africa has helped Thailand, since smaller



loads can be shipped more often with fewer losses. Nonetheless, the scale of the trade is such that the market will continue to see 20,000 tons and more shipped at a time from Thailand to Africa.

The top exporters to Ghana and Senegal include Asia Golden Rice, Olam, CP Intertrade, Capital, and Chia Meng. Some are starting to base operations in Africa. Going down the value chain, exporters such as Olam are already well established in Africa, with a network of warehousing and distribution. CP Intertrade has reportedly followed Olam's lead and has now established closer links in Benin and Senegal. Other major exporters are also considering how to develop their relationship with the African market.

Storage is an important capability for the exporters. One of the major competitive advantages of Thailand as an origin is its ability to deliver prompt shipment, which derives from the ability to hold product. Further, rice quality changes in storage, and distributors in Ghana reportedly require Hom Mali from the previous season rather than current season. Perhaps this shows just how well the Thai industry has moved from transactional marketing to a relational approach.

Exporter costs are estimated at THB 1,000–1,200 per ton from delivered at their gate to FOB. Thai Hom Mali is more expensive by about THB 450 per ton, as it requires further drying, and, if stored over time, lower temperatures to avoid deterioration in its volatile aromatic properties.

A new development in this otherwise quite traditional sector is the arrival of Olam (Thailand) Ltd., which until three years ago confined its activities to international trading and buying from exporters to sell in distant markets. Olam now has facilities at a site on the Tha Chin River not far from the sea, with a capacity to reprocess 250,000 tons of rice per year.

Linkages

Thailand has a strong cooperative movement. The first cooperative was brought to the country by the initiative of the Thai government in 1916 as a tool to help the severely indebted farmers. Currently 3,850 agricultural co-operative societies are in operation, encompassing about 6 million individual members. Further along the rice value chain, millers are represented by the Thai Rice Millers Association, and exporters are represented by the Thai Rice Exporters' Association,⁸ discussed earlier. As noted, there are historic links between exporters and millers. There are still many family connections, and many of the key trading houses belong to ethnically Chinese families. Figure A1.16 summarizes the linkages in the value chain.

Institutional support

Farm price intervention. Since the 1980s, the Thai government has more or less withdrawn from price intervention and direct purchasing in the domestic rice sector and has allowed the world market to determine national rice prices. It still intervened indirectly, however, by providing optional support measures for farmers. Until the mid-1990s, the result of all interventions and policies concerning rice could be considered a net tax on rice production.

Intervention returned in the late 1990s in the form of government policies on price (paddy pledging/mortgage scheme, 1982–2008) and income (insurance scheme, 2009–11) support. Both policies were open to criticism from the players in the rice sector. In October 2011, a revised form of a previous paddy-pledging scheme was put into effect by the newly elected administration (Table A1.5).

⁸ See <http://www.thairiceexporters.or.th>.



On 13 September, 2011, the Thai Cabinet approved US\$ 13.7 billion of a credit line and US\$ 0.9 billion of a budget for the administration and storage cost of the Paddy Pledging Program for the 2011–12 main paddy crop, starting on October 7, 2011 and running until February 29, 2012. The government considered extending the program to the end of March 2012 to include farmers who had to replant following serious floods in October 2011.

The intervention prices were set approximately 50 percent higher than current market prices for white rice and 30.0 percent for fragrant rice. The program is more aggressive than the previous paddy-pledging program, when intervention prices were 20 percent above market prices. No limits were imposed on the amount that can be pledged, as the budget will cover all 2011–12 main-crop paddy production. Farmers will be able to obtain immediate, interest-free cash loans after bringing their paddy to designated mills. They will be able to redeem their paddy within four months for the amount of the interest-free loan or forfeit the rice and keep the cash. During the first phase of the program (October 7 to mid-December 2011), the BAAC was to provide a credit line equivalent to US\$ 3 billion, sufficient to purchase only 6–7 million tons of paddy; the remainder would be covered by loans from other government banks.

This program proved very controversial. Many sectors voiced concerns over possible losses amounting to US\$ 3–8 billion if the program were extended to the 2011–12 off-season crop.

A recent report⁹ concluded that about 70 percent of rice farmers were likely to be worse off under the Paddy Pledging Program compared to the previous Price Insurance Program. In past pledging programs, participation amounted to only one-third of rice farmers, mostly large-scale farmers in the Central Plain. Small-scale farmers, especially those in the Northeast with 2–3 hectares,

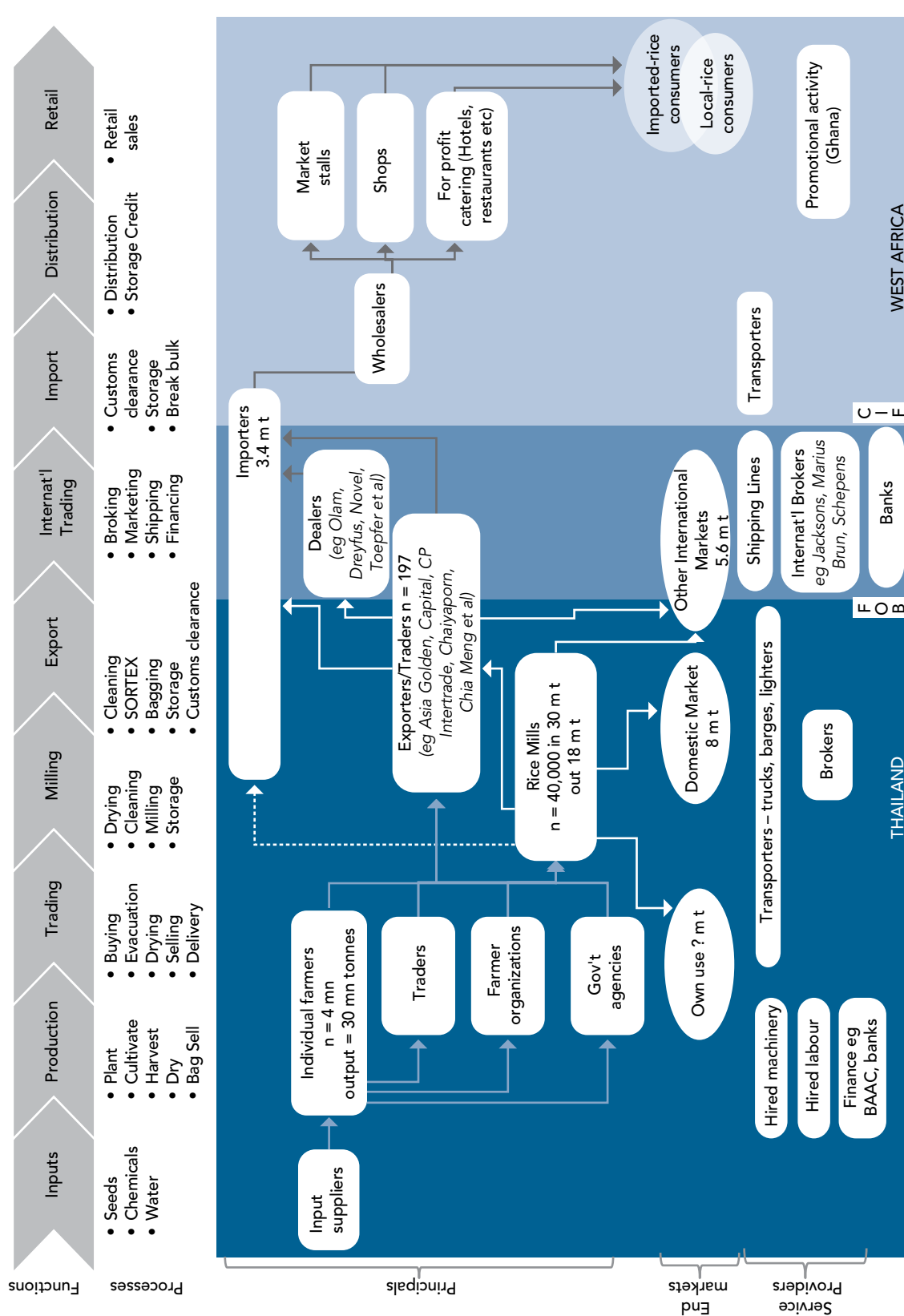
Table A1.5: Key aspects of the two latest price intervention policies

Rice Price Guarantee Policy		Rice Mortgage Policy 2011–12
Covers rice planted both for personal use and for commercial sale	COVERAGE	Covers only rice that is commercially sold
Each farmer can receive a price guarantee on up to 30 tons per rice type per harvest	LIMIT	There is no limit on the amount of rice that farmers can mortgage
The loan is given to farmers based on the area of land sown	BASIS	The loan is given to farmers based on the quantity of rice harvested
If there are floods, farmers are reimbursed in two separate installments: (1) THB 2,000/rai (US\$ 10.65/ha) planted to rice; (2) the difference between the market price of the rice they lost and the price guarantee	INSURANCE	If there are floods, farmers are reimbursed THB 2,200/rai (US\$ 11.7/ha) sown
<i>Price guarantees in 2010–July 2011:</i> Hom Mali: THB 15,300/t (US\$ 510/t) Pathumthani: THB 11,000/t (US\$ 367/t) White rice: THB 10,000/t (US\$ 334/t) Glutinous rice: THB 9,500/t (US\$ 317/t)	PRICE	<i>Price guarantee until end-Feb 2012:</i> Hom Mali: THB 20,000/t (US\$ 667/t) Pathumthani: THB 16,000/t (US\$ 534/t) White rice: THB 15,000/t (US\$ 500/t) Glutinous rice: THB 15,000/t (US\$ 500/t)

Source: Authors

⁹ From the United States Department of Agriculture Foreign Agriculture Service; see TH1125 3 October, 2011, http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Update_Bangkok_Thailand_10-3-2011.pdf.

Figure A1.16: The rice value chain in Thailand



Source: Authors

will have limited ability to participate in the program due to liquidity and logistical concerns. They will be forced to sell at market prices, which are usually far below the intervention prices.

With the pledging program, the Thai Rice Exporters Association believes the country will lose a significant share of the global market, because its prices will not be competitive. The white rice pledged price will increase the export price to more than US\$ 800 per ton from the current US\$ 630 per ton, while Vietnamese rice will increase from US\$ 550 per ton to only US\$ 700 per ton. Vietnam plans to take advantage of the new Thai policy, with exports expected to grow as much as 7 million tons in 2012.

Economists have warned that the government could experience seriously financial losses under the pledging program. The Thailand Development Research Institute said that the promised high prices would encourage farmers to plant more rice, causing the government to spend more to keep rice prices at the promised levels. The institute also said that the government might have to buy 10 million tons of paddy in the next year to meet its promises. At some point, the government may be forced to dump excess rice at a loss on the open market. The government suffered huge losses, amounting to US\$ 628 million, from a previous paddy-pledging program.

Future R&D policy. The Bureau of Rice Research and Development has prioritized the following areas:

- Increase rice production efficiency (breeding and varietal development to maximize yield potential).
- Reduce yield losses and stabilize yields.
- Expand capacity for seed production and accelerate seed certification.
- Conserve biodiversity of rice genetic resources in situ (in farmers' fields).
- Focus on food safety and sustainability (reduce/control use of fertilizers and other on-farm chemical inputs; introduce low-input sustainable rice production systems).
- Work on value-added aspects of commercialization and exploit associated varieties.
- Conduct research on adaptability to climate change; reduction of toxic waste emissions.
- Enhance farmers' capacity building and empower farmers' groups (better dissemination of agronomic technology and market information directly to farmers).
- Upgrade post-harvest technology; increase milling quality for value-added end products.
- Targets for 2015: Raise rice productivity by 10 percent; lower production costs by 15 percent; raise Hom Mali (KDML 105) quality by 20 percent; significantly reduce use of inorganic fertilizers.

The 11th National Economic and Social Development Plan (2012–16)¹⁰ in relation to agriculture gives priority to strategies for balancing food and energy security:

- Develop natural resources in order to strengthen the agricultural base.
- Enhance agricultural productivity and value-added creation.
- Promote job and income security for farmers.

¹⁰ The Thai National Development Plan, Thai National and Economic Social Development Board (NESDB); see http://www.nesdb.go.th/Portals/0/home/interest/11/data_0420270111.pdf.



- Enhance food and fuel security at household and community level.
- Develop energy security to support national development and the agricultural sector.
- Improve agricultural management to ensure the balance of food and energy.

Regional competition

With an output of around 7 million tons of paddy per year, Cambodia is a relatively small player in the region, but its rice production is increasing. Cambodia—which borders Thailand’s jasmine rice growing area—is likely to be the only other area capable of growing Hom Mali rice. Several other aromatic varieties are also available to Cambodian farmers. Cambodia’s borders with Thailand and Vietnam are quite porous. To find the best market, paddy leaves North West Cambodia for Thailand, and some milled fragrant rice makes its way against this flow into Cambodia. Several Thai mills and exporters are looking at opportunities for investment in Cambodia.

Vietnam has developed into a major rice exporter over the last 20–25 years. In 1989, the Government of Vietnam agreed to export some 1.4 million tons of rice from the Mekong Delta, and around this time rice production in Vietnam surpassed production in Thailand. Exports from Vietnam now exceed 6 million tons of milled rice per year, from a national production of 39 million tons of paddy rice. Vietnam is a low-cost producer, and its exports of long-grain white rice can out-compete Thai exports on price. The Thai industry responded to this threat by focusing on the recognized superiority and quality of the varieties it exported. In recent years, aromatic rice exports from Thailand have risen, but the Thai industry has also focused on competitive attributes such as packaging and reliable availability. At the same time, Vietnam has gained market share in Africa. Some of its exports are long-grain white rice, yet its increasing exports of aromatic rice stand to threaten Thailand’s position among rice exporters.

Senegal

Overview

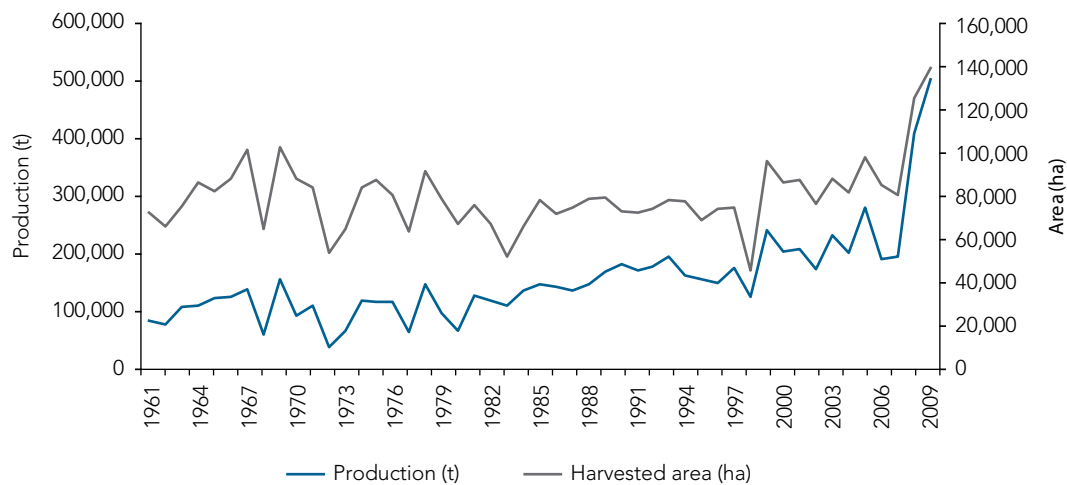
In both value and quantity, rice is the third most import agricultural product in Senegal after groundnuts and millet. Annual production of rice has fluctuated between 200,000 and 250,000 tons of paddy based on around 90,000 hectares for much of the decade, but data for 2009 and 2010 show a jump in output to over 500,000 tons of paddy (Figure A1.17).

The long-term growth in output derives both from expanding area and also from rising yields, which are estimated to have climbed from around 2 tons per hectare in the 1980s to nearer 3 tons per hectare in recent years. The more recent jump in output, which coincided with the start of the GOANA¹¹ initiative to achieve self-sufficiency by 2015, is attributed to good weather, improved subsidy programs, and producers’ response to high global prices.

Despite the expansion of local rice production, domestic output has failed to keep pace with growing demand, and Senegal remains a major rice importer. Traditionally staple grains such as millet and sorghum have been surpassed by rice in the last 50 years as the most import cereal in the

¹¹ Grande offensive agricole pour la nourriture et l’abondance (GOANA)—a presidential initiative to achieve food self-sufficiency by 2015, with a particular focus on rice in the Senegal River Valley.



Figure A1.17: Rice production in Senegal

Source: FAOSTAT.

Senegalese diet. Consumption countrywide approaches 90 kilograms per capita per year, a number that masks the urban population's high consumption level, which exceeds 100 kilograms per capita per year. These consumption levels are similar to those seen among the Asian rice-producing countries. Senegal satisfies its demand for about 1 million tons of rice per year through annual imports of some 800,000 tons. Household expenditures on rice are on the order of 8 percent of household income in Dakar, and the urban poor dedicate 10 percent of their incomes to buy rice.

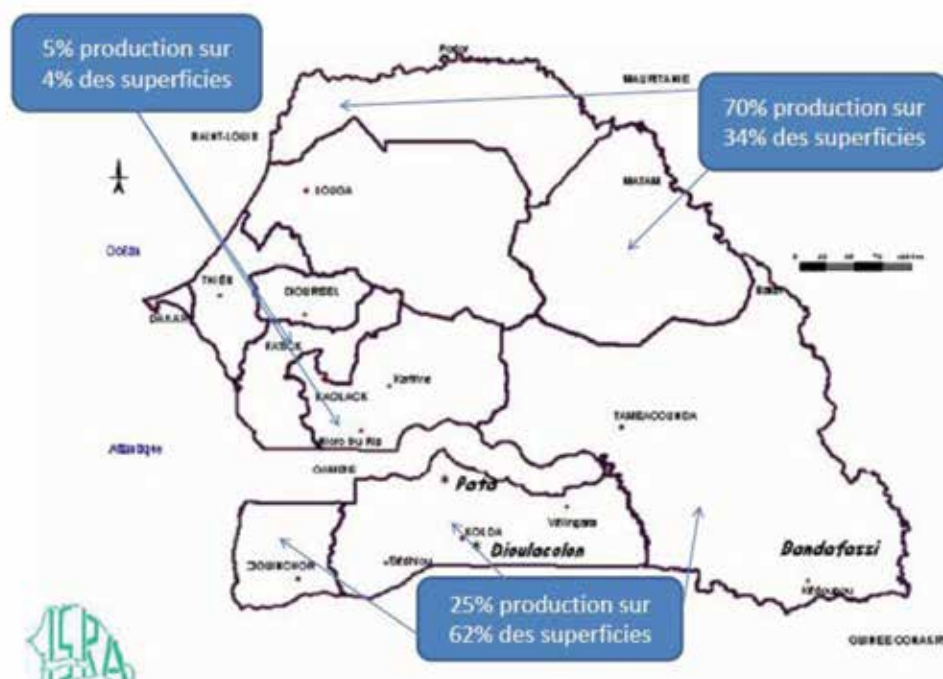
Figure A1.18 depicts Senegal's three main rice-producing regions. The principal producing area is the Senegal River Valley alongside the Senegal River, which forms a boundary with Mauritania, and its tributaries. Here rice is grown on irrigated land with the possibility of two rice crops per year and a third crop of tomatoes or vegetables.

Further production, most of it rainfed but some of it under managed water retention schemes, is found in the Casamance Region of southern Senegal, beyond Gambia, and also in the Kaolack-Fatick area to the north of Gambia. Although rice area in these areas is important, productivity is low. The rice remains almost entirely within the production area: Subsistence production is common, but even the rice that is marketed tends to be consumed within the immediate area.

In this sense, the competitiveness of domestic rice against imported rice is principally an issue for rice produced in the Senegal River Valley, which will be the focus of this discussion. The intention is not to imply that productivity in the Casamance or Kaolack areas cannot improve. Additional use of fertilizer, improved seed, and better water management and land preparation all have the potential to narrow the yield gap and significantly increase rice output and rural income in these areas. But rice here is protected from imports by high distribution costs and (more important) consumer preferences, so imported rice has limited relevance. For the most part, the domestic resource cost of rice here (with the exception of irrigated rice at Anambé, to the east of Kolda) is 0.47¹² (2006), indicating that rice can be grown profitably.

¹² Fall, personal communication.

Figure A1.18: Rice production in Senegal



Source: ISRA.

Overall, rice appears to be profitable in Senegal. Calculations indicate financial receipts in the local rice sector on the order of CFA 32 billion and overall costs of CFA 26.72 billion, implying a financial profit of CFA 4.83 billion, though the local rice sector receives a net transfer of CFA 6.72 billion from the nationwide economy.¹³

Markets and consumers in Senegal

Urban and rural consumers have markedly different preferences for rice. Urban consumers tend to prefer imported broken rice, whereas rural consumers demand whole or mostly whole local rice (Figure A1.19).

The large and growing urban population is a key factor in the market opportunity for locally produced rice. Research, notably by AfricaRice, has continued to clarify why urban consumers have such marked preferences for imported rice. Rice was introduced to urban consumers in the colonial period, and they developed a preference for the high quality (in terms of grading, cleanliness, and preparation) of imported rice, which was easy to prepare and cook. The rice was affordable because Senegal imported broken grades, which at the time were a byproduct of the milling industry. The broken grains are now much preferred for particular dishes, such as the typical rice and fish *céebu jën* (*thieboudienne*). Among rural people, who grew rice for themselves, these quality aspects were not considered important. If broken rice was required, the cook would sort the rice. More recently,

¹³ BAME (2006).

the urban population has developed a taste for the aromatic rice of Thailand, which has added further complexity to understanding the spectrum of consumer preferences that drive the market for rice in Senegal.

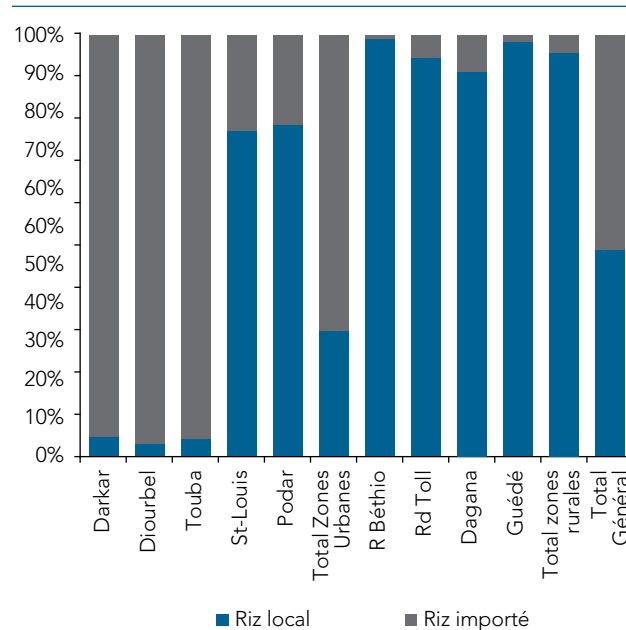
Market research¹⁴ has shown that the characteristics of primary importance to the urban shopper in selecting rice are cleanliness, ease of preparation, absence of stickiness, taste, and price, among others. The shoppers interviewed listed aroma/fragrance quite low among their expectations, but as discussed later, aromatic Thai rice now constitutes about one-quarter of imports and is likely to be priced beyond the reach of the average shopper.

The urban population's connection to imported rice had become so strong that a survey¹⁵ in 2007 showed that one-quarter of those interviewed were unaware that local rice was available in the market. More detailed tests, and particularly the use of experimental auctions¹⁶ among urban shoppers, have shown that while consumers are prepared to pay a 17 percent price premium for imported Thai 100 percent broken rice relative to the standard Senegal River Valley rice, when offered Senegal River Valley rice of enhanced quality they showed a willingness to pay a premium up to 32 percent, or even 38 percent for the branded "Rival"¹⁷ product. This finding is even more surprising and encouraging in light of the fact that brands have had little impact on the rice trade in Senegal, and only the premium end of the market places any importance on branding.

Water management

About 4 percent of Senegal's arable land is irrigated. The government would like to see it expand to 10 percent. Some 60,000 hectares are under water management in the Senegal River Valley; some

Figure A1.19: Preferences for imported or local rice among rural and urban housewives in Senegal



Source: Fall et al. 2007.

Note: Dakar (capital city); Diourbel and Touba (inland urban markets); St Louis and Podar (Senegal River Valley urban markets); All others (rural markets); Rd Toll (Richard Toll); R Béthio (Ross Béthio).

¹⁴ Fall (2007); USAID Projet Croissance Économique (2010); Demont et al. (2010).

¹⁵ Fall (2007).

¹⁶ Demont et al. (2010).

¹⁷ Rival (Riz de la vallée) is a brand of Senegal River Valley rice of enhanced quality developed by the Oxfam-funded platform (PINORD). The launch in 2007 has been followed by an expansion of output to around 8,000 tons, a significant achievement, but scaling up sufficiently to have an impact in the 1 million ton national market is problematic.

250,000 hectares could be rehabilitated for water management. Of the 347,000 hectares in the Senegal River Valley, about 100,000 have been developed, but an additional 35,000 could be used for agriculture.

Finance

Credit for purchasing inputs and paying land, labor, and irrigation costs is provided by the Caisse National de Crédit Agricole du Sénégal (CNCAS). It is available to farmers organized into producer groups (Groupements d'Intérêt Économique, GIE). Credit is available at an annualized rate of 7.5 percent compared to a commercial bank rate of 12 percent,¹⁸ although by the time all the costs of obtaining credit have been included, the true cost is nearer 12 percent. A seasonal reference price is agreed upon by a committee of stakeholders¹⁹ and determines the quantity of paddy rice that must be delivered by a farmer to the GIE to repay the loan. This rice is then sold. Half of the Senegal River Valley rice crop is estimated to be marketed this way.²⁰

Seed supply

Certified seed is multiplied and distributed by some 30 operators, most of whom are members of the National Union of Professional Seed Growers (Union Nationale Interprofessionnelle des Semences). They obtain foundation seed from the Senegalese Agricultural Research Institute (Institut sénégalais de recherches agricoles, ISRA) which supplies a range of about 20 varieties that have been tested and selected for their suitability to particular soil types and seasons. Of these, three varieties (Sahel 177, Sahel 328, and Sahel 329) are newly released (July 2011) aromatic varieties developed to capture some of the demand currently supplied by imports of Thai scented rice. Production of certified seed is increasing, although the annual supply is inadequate. Figures for 2007²¹ show a seed supply of 3,000 tons, which at typical seeding rates provides planting material for only about 23,000 hectares. Since planting certified seed is a requirement for CNCAS financing, the shortage is a problem. For the most part, rice farmers save seed from year to year for replanting or buy seed in the local markets.

Chemical inputs

The coastal region that extends from Dakar to Saint Louis, known as the Niayes, is a focus of horticultural production in Senegal. Agriculture there is relatively intensive, and there are some substantial installations. The fertilizer industry is concentrated in this area and latterly has extended into the irrigated areas of the Senegal River Valley. Fertilizers are sourced by around 10 major importers, which supply a network of distributors. Typically, rice farmers apply urea and diammonium phosphate. For rice farmers, only urea prices are subsidized.

¹⁸ Inflation is currently estimated at 3 percent.

¹⁹ Drawn from farmers, traders, processors, CNCAS, and ARM—collectively the Comité de Pilotage de la Filière Riz (CPR).

²⁰ Demont, personal communication.

²¹ Direction Régionale du Développement Rural.



Labor and mechanization

A level of mechanization has been achieved in the Senegal River Valley that reduces the labor input significantly compared to an entirely labor-based system. Significant opportunities remain to exchange mechanical power for human or animal power throughout the production cycle and after the harvest, yet no clear policy or strategy has been developed on this issue. For land preparation, an offset disc harrow is often used with a tractor to assist the largely manual operations of repairing bunds and leveling land. Inadequate land preparation is one reason why herbicide use is so high. Planting is usually done by hand, either by broadcasting seed or transplanting (although transplanting is done only on smaller plots). Applications of fertilizer and other pesticides generally involve knapsack sprayers. At harvest, it is estimated that only 6 percent²² of the Senegal River Valley crop is harvested using combine harvesters, and the process is either entirely manual or the reaping is manual and the threshing mechanized. Combines have been supplied under various schemes but are generally either of an inappropriate scale or maybe too expensive to maintain. The greater proportion of the Senegal River Valley crop is now threshed mechanically using the ASI thresher.²³

If harvesting of the dry season crop is delayed, the harvested crop may need to be dried. Facilities for drying are limited. In areas of heavy concentrated production, rice is dried on the roads and any open ground available, which reduces quality and increases losses.

Commercialization

Rice in the Senegal River Valley is largely grown using credit that is repaid with the harvested rice. As noted, under the reference price established for the season by CPER, a quantity of harvested paddy is delivered to the GIE to repay CNCAS. The land management and allocation society for the Senegal River Basin (Société nationale d'aménagement et d'exploitation des terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé, SAED) estimates that about one-third of the crop is marketed in this way. The remainder may be stored until there is less local rice from the credit repayments on the market, but a certain amount is retained throughout the year for family consumption and replanting. Retention for household use accounts for another third of the Senegal River Valley paddy crop, leaving only one-third to be actively marketed. This rice is sold either to itinerant traders, the so called *Bana-Banas*, or sold by the producer in local markets.

Milling

The milling sector in Senegal is fragmented, mostly small-scale, and undercapitalized. There are a number of "industrial" scale mills operating at 1.5–3 tons per hour, and some 300–400 village-level decorticators. According to SAED and the Japan International Cooperation Agency (JICA), Senegal has some 25 functional rice mills, of which perhaps 12 have been installed since 2000. The total

²² Fall, personal communication.

²³ Introduced in 1997 and developed in a collaboration between AfricaRice, the International Rice Research Institute (IRRI), ISRA, and SAED. The design is based on modifications to a thresher introduced by IRRI in 1995. The cost of the machinery and operator is charged at 10 percent of production. The savings in labor are significant, and grains losses are reduced in comparison to manual threshing



capacity of these mills is about 80,000 tons per season, which might be extended to 130,000 tons for double cropping. The newer mills have been built by entrepreneurs or by producer organizations (GIEs), often with funding from the Arab Bank for Economic Development in Africa (BADEA).

Without the capability to purchase paddy rice, the mills, if not owned by GIE, usually operate as a service, charging a fixed fee of CFA 16 per kilogram of milled rice.²⁴ Recovery rates are said to be about 67 percent, though poorly prepared paddy may only yield 48 percent white rice. Breakage rates are elevated by the high heat during the crop growth cycle and over-ripening caused by harvesting delays when equipment and labor are not available. Since consumer demand is focused on broken rice, breakage is not necessarily a problem.

The husk is sold as fuel or dumped; the bran is returned to the owner of the paddy and sold for animal feed either locally or to Mauritanian traders, as the whole region has an important live-stock industry. One of the largest mills, Coumba Nor Thiam at Rosso, recently installed a power generator that uses biogas from rice husks. The operating efficiency and return on this investment is not yet known, though it is an interesting pilot effort in a region that produces more than 60,000 tons of bran per year.

A survey in 2008/09 (AFD 2009) estimated that of the total Senegal River Valley paddy crop of 300,000 tons (dry season 2008 plus wet season 2008/09), 17 percent (51,000 tons) was handled by the industrial mills and 83 percent by village decorticators. Since the village decorticators are largely unable to produce rice to any quality standard,²⁵ it is clear that the milling stage in the value chain represents a major impediment to processing rice that can compete with imported rice of generally higher quality. The practice of paying a fixed price for the quantity processed provides little incentive for most rice mills to attempt to match the quality of imported rice. Only a few of the larger mills have any grading capability.

Distribution

Rice marketed either by individuals or by producer organizations to repay credit passes through four channels. It may be decorticated locally and then sold to petty traders (*Bana-Banas*), or it may be sold direct as paddy to the *Bana-Banas*. Alternatively it may be sold or processed by the larger industrial mills and then sold to the wholesalers. Wholesalers may also acquire paddy from farmers, producer organizations, or *Bana-Banas*. The white rice is then marketed throughout the Senegal River Valley. White rice assembled by the wholesalers is also taken further to the larger urban centers; usually only the larger wholesalers deliver to those markets. At peak harvest times, Mauritanian traders also participate in the market; a significant quantity of paddy is sold to be processed in Mauritania.

The relative quantities travelling through each channel are not recorded and probably vary quite significantly with the availability of funds or with seasonal imbalances in supply and demand. The rice that reaches major urban markets and competes directly with imported rice is only the rice processed in the bigger mills (and only those capable of grading and sorting) and passed on to the larger wholesalers. If the estimates provided earlier are reliable, then only 51,000 tons of paddy are

²⁴ Not adjusted since 2009.

²⁵ Most have no capability to polish or grade/sort.



processed for this market, and perhaps 20 percent will be unsuitable as ungraded, suggesting that only about 27,000²⁶ tons of Senegal River Valley white rice actually compete in the urban markets and offer a real alternative to imported rice. In other words, Senegal's level of self-sufficiency in producing rice of a quality acceptable to urban consumers is about 4 percent, assuming average imports of 800,000 tons.

Linkages

While horizontal linkages abound in the Senegal River Valley, the vertical linkages are notoriously absent, and the value chain is fragmented. At the village level, producers were encouraged to establish formal structures for management and co-operation as the rice sector was liberalized in the 1990s. There are now Water Unions to manage the operation of the irrigation schemes as well as co-operatives and development associations. The GIEs are the most numerous type of producer organization and may provide a wide range of services to members, extending from management to sourcing credit or inputs. It is significant that marketing, after the repayment of any loans, tends to be handled individually, with no clear market linkages. While some GIEs now own larger mills and entrepreneurs with mills are seeking the capacity to produce sufficient rice for their operations, the proportion of rice that actually passes through a linked value chain remains small.

A new initiative under GOANA has created the Société d'encadrement agricole (SOENA) to improve the marketing of agricultural produce, including rice. A link with the Dakar-based conglomerate CCBM, which operates a chain of mini-markets, seeks to link producers to its retail outlets. There are three entities within SOENA: CODERIZ, a rice production company with 2,000 hectares to the west of Richard Toll being cleared in 2011; TSE, an input company providing chemicals and equipment for rice production; and CCBM, which will market produce through its Easy and Prix Doux stores.

Institutional support

Support to the rice sector is provided by a number of institutions that have emerged in the 16 years since liberalization. They cover most areas of rice activity, and there is the sense that the bureaucratic load on the sector is increasing.

- *Association des risiers du nord* groups a number of mills in the Senegal River Valley. It is not clear how many remain active.
- *Plateforme des initiatives du nord* (PINORD) was established in 2002 with the support of the development charity Oxfam to group some six associations with 85,000 members for whom rice production was the principal activity. The organization seeks to contribute to food security and welfare in the region through the promotion of locally grown rice. PINORD continues an association with Oxfam but is now also funded by FAO, USAID Projet Croissance Economique (PCE), and other donor partners. As noted, one recent initiative was to develop the brand Rival by linking PINORD's large number of producers with

²⁶ Eighty percent of 51,000 is 41,000 tons, yielding 27,000 tons of white rice.



mills that can produce rice to certain quality standards. Rival thus offers traceability and a guaranteed standard together with a brand. By 2010, 7,400 tons of Rival were marketed. Consumer response has been good, but the problem of scaling up and achieving a significant impact in the wider market remains.

- *Le comité de pilotage de la filière riz* (CPER) groups a number of stakeholders through the value chain, including SAED, CNCAS, and ARM.²⁷ Every season, these stakeholders set the reference price for paddy, processing, and white rice.
- *Le comité interprofessionnel du riz* (CIRIZ) is an advocacy group that functions as an apex or umbrella organization for a number of subsidiaries incorporating actors from the value chain.

State or parastatal institutions include:

- *Société nationale d'aménagement et d'exploitation des terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé* (SAED). SAED was one of the few organizations from the period of state control to survive the liberalization of the rice sector in 1994/95, albeit in a much changed form. Today, the mission of SAED is to develop irrigated agriculture along the Senegal River and its tributary, the Falémé. SAED provides the development and management for irrigation infrastructure projects and supports the production of rice (and other crops) through technical assistance and extension to farmers. It is not involved in marketing rice.
- *L'Institut Sénégalais de recherche agricoles* (ISRA) has six regional centers, one of which is in Saint Louis and has responsibility, inter alia, for rice technical research in the Senegal River Valley region. ISRA also tests rice seed and provides genetic stock to seed multipliers.
- *Agence nationale de conseil agricole et rurale* (ANCAR) is mandated to support rice farmers in areas other than the Senegal River Valley, which is SAED's domain.
- *Caisse nationale de crédit agricole du Sénégal* (CNCAS), the agricultural credit provider, also survived the period of state control and the upheavals of liberalization. CNCAS operates in areas where commercial banks are rare and, as mentioned, offers loans at rates significantly below those of commercial banks. For this reason, the bank depends on state and donor subsidies and is not exposed to market competition.
- *L'Agence de Régulation des Marchés* (ARM) began immediately after liberalization as the government entity responsible for oversight of the rice market. ARM began as a market information system for rice but its operations now encompass all major crops, although rice still makes up 50 percent of its activity. While the maintenance of rice stocks is in the hands of the private sector, ARM is seeking involvement in the infrastructure. It also plans to become more involved in rice marketing through a newly created entity, the *Société de promotion et de commercialization du riz Sénégalais* (SPCRS), which will be owned by producers, millers, and importers. As of mid-2011, however, SPCRS had yet to begin activity.

²⁷ SAED = Société nationale d'aménagement et d'exploitation des terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé; CNCAS = Caisse nationale de crédit agricole du Sénégal; ARM = L'Agence de Régulation des Marchés.



- *Le Commissariat à la sécurité alimentaire (CSA)* is tasked with monitoring a sample of markets to record supplies and commodity prices.

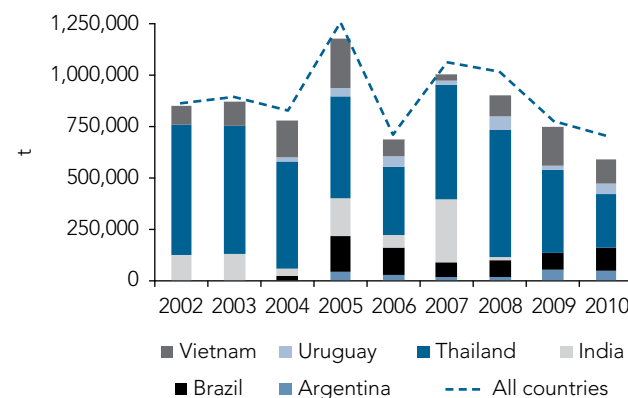
Imports

Origins. Imports of rice into Senegal show a decline over the past six years. The peak imports of around 1 million tons of rice had fallen to 700,000 tons in 2010. Meanwhile, wheat imports rose from 265,000 tons in 2002 to 436,000 tons in 2010. The origin of rice supplies to Senegal has changed in recent years (Figure A1.20). In 2002, Thailand supplied 74 percent of Senegalese imports; Vietnam and India provided most of the rest. In 2010, India was no longer a rice supplier, though the lifting of the export ban in 2011 could change that. Thailand has lost market share (to 37 percent) to Argentina, Brazil, and Uruguay.

The decline in Thai market share reflects the move away from the more expensive aromatic rice types to Thai Pathumthani or aromatic Vietnamese rice, as well as the move to white rice and more competitive suppliers of white rice. Imports of Hom Mali from Thailand fell from 2007, but they have held steady over the past three years despite the overall fall in the share of rice imported from Thailand from 61 percent to 37 percent (Figure A1.21). With high Thai prices through 2011, it is unlikely that demand for aromatic rice will have increased this year, and the future probably lies with lower-priced substitutes such as Pathumthani.

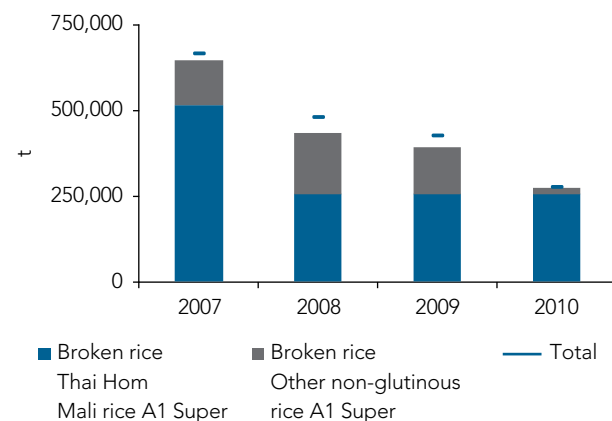
Importers. Up to 1994/95, the government controlled rice imports, and the rice was handled by a number of import companies acting as agents. From 1995, rice imports were liberalized, and where the number of importers initially grew, about 14 rice importers remain active in Dakar, with the bulk of the trade concentrated among the top three or four.

Figure A1.20: Imports of rice into Senegal, 2002–10, by major origin



Source: COMTRADE data.

Figure A1.21: Exports of rice from Thailand to Senegal, 2007–10, by type



Source: Thai Customs Authority.

The external linkages vary. Aside from the small importers, Olam has connections to its international trade house and its recently established export operation in Thailand, Sencom collaborates with the giant Thai agribusiness CP Intertrade, and Novel operates a Dakar-based agency of Novel Commodities in Geneva. As mentioned, most rice arrives in bags or in bulk; a rather small quantity arrives by container.

According to importers, state intervention in the trade has a poor history. The sequence of events in 2008, when global rice prices rose dramatically, caused particular difficulty for a number of importers. In the first place, the Government of Senegal declared its intention to pay the difference if the price of rice rose above CFA 255 per kilogram. The intent to pay within 10 days proved ambitious; the first payment was made only after six weeks. Second, at the start of July 2008, the Prime Minister commanded the purchase of further rice supplies despite the high price levels prevailing in the world market. Orders made in July arrived in Dakar in October (as a consequence of the normal cycle of negotiation, documentation, accumulation of the shipment and the voyage time). By that time, the world price had fallen. The government subvention was lifted in September, and by mid-October the import tax, which had been lifted in 2007, was restored. Importers incurred significant losses, and the range of importers operating in the market has changed since then.

Tariffs and duties. The application of duties and levies on rice imports adds an immediate 12.9 percent to the CIF value of rice (Table A1.6).

Distribution. Onward distribution of rice from importers is handled by 30 or more distributors, which vary in capacity and capability from substantial operations with their own trucks to smaller wholesalers. A few are also involved in the local rice trade, bringing rice down from the Senegal River Valley. Imported rice is distributed only within Dakar and to the main cities such as Touba, Thies, Saint Louis, and Kaolack. Smaller quantities are distributed further but become less competitive. The chain from importer to consumer is relatively simple, with the rice passing to wholesalers/distributors, which in turn sell to retailers. Occasionally brokers may be involved, but this is rare.

Costs. The distribution of imported rice is competitive, and margins are quite slim. Distribution costs and margins (for Dakar)²⁸ are estimated to account for less than 3.5 percent of the final retail price of imported Thai rice. Transport can be a significant cost for inland distribution, but most imported rice is sold within Dakar.

Table A1.6: Duties and levies on rice imports to Senegal

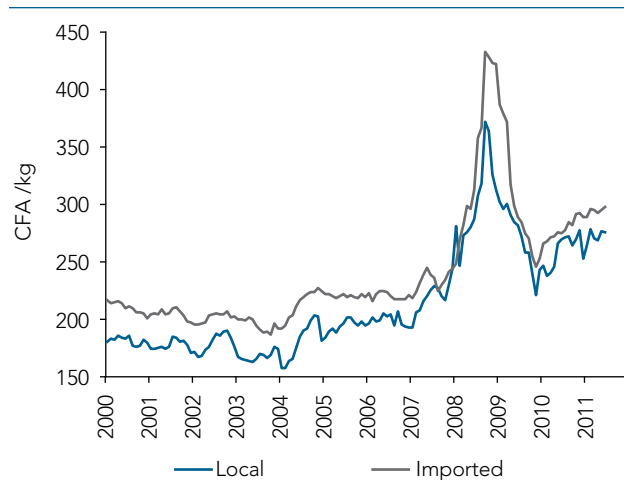
	Rate (%) applied to CIF
Import duty	10.0
Statistics	1.0
Cosec (Senegalese Shippers Council)	0.4
UEMOA	1.0
CEDEAO	0.5

Source: ARM.

Note: These rates apply to all forms of rice—milled, brown, or paddy. VAT is not applied. UEMOA = West African Economic Monetary Union. CEDEAO = Economic Community of West African States.

²⁸ That is, from the importer onward (and not including port costs).

Figure A1.22: National average monthly prices for rice in Senegal, 2000–11



Source: ARM.

Market prices. The price of imported rice strongly influences the market price of locally produced rice (Figure A1.22). Since the price spike of 2008, price levels have remained higher than the long-run average since 2000.

Government strategy

Following liberalization of the rice sector in 1994/95, the government led several initiatives to support the sector, and rice has featured in wider economic programs. In 2005, the new National Program for Self-Sufficiency in Rice (PNAR)²⁹ set a target to produce 1 million tons of white rice by 2012. In support of the program, the

Prime Minister's office issued a policy statement on boosting rice farming to achieve 500,000 tons by 2010. A national strategy was formulated to develop rice production based on four components: (1) land management, (2) irrigation equipment and supplies, (3) funding of production and post-harvest operations, and (4) marketing.

Achieving the ambitious targets would require 1.5 million tons of paddy production—1.1 million tons from irrigated cultivation, almost entirely in the Senegal River Valley, supplemented by rainfed output from the Anambé Basin in Casamance. The increased expectations from the Senegal River Valley would entail extensive rehabilitation of irrigated land as well as new development, the provision of agricultural machinery, and milling equipment. It is interesting to note that marketing was included in the program, since it was recognized as a bottleneck in the value chain but had previously received little attention.

The current national rice strategy is encapsulated in the Presidential food security initiative, GOANA, mentioned earlier. GOANA was launched in 2008 following two poor crop years and the rapid rise in global grain prices. PNAR is contained within this initiative. After Mauritania, Senegal is West Africa's most food-import-dependent country, and GOANA's goal is to achieve annual increases in output leading to self-sufficiency in food production by 2015 (Table A1.7). As might be expected, GOANA gives great attention to the Senegal River Valley for increasing rice production.

GOANA focuses on expanding cultivated area, irrigation, and diversification. It improves access to inputs by improving their availability and subsidizing their cost. The total costs of GOANA are estimated to vary from US\$ 800 million to US\$ 1.8 billion, but the budget for rice alone appears to be US\$ 390 million, rather more than the government budget for investment in agriculture for the four years prior to GOANA. While there is general agreement that the direction taken by the

²⁹ Programme nationale d'autosuffisance en riz.

Table A1.7: GOANA production targets for 2008/09

Crop	Production in 2007/08	Target for 2008/09	Increase
	000 t		%
Rice	195	500	256
Maize	160	2,000	1,250
Millet	320	1,000	313
Sorghum	100	500	500
Fonio	1	25	2,500
Cassava	310	3,000	968
Groundnuts	330	1,000	303
Cotton	45	60	133
Horticultural crops	570	720	126

Source: Ministry of Agriculture.

initiative is good, critics point to the absence of attention to processing and commercialization, which are crucial for advancing rice sector. A further concern is that the will to succeed is distorting the objective collection of statistics on agricultural production.

GOANA is implemented by the Ministry of Agriculture and APIX, the Senegalese investment promotion agency.³⁰ APIX is responsible for offering investment opportunities in the sector to private operators that can participate equally in the development and management of this initiative. So far, the private sector response has been limited.

Conclusions

Rice policies do not appear to fully reflect the implications of the dichotomy in Senegal's rice market between local and imported rice. It is important to understand that imported and locally grown rice serve two roughly distinct markets. Despite some overlap, for the most part imported rice is consumed in urban centers and local rice is consumed in rural regions. The only local rice that reaches the urban population is produced by a few larger mills capable of meeting the quality specifications that enable local rice to compete with imported rice. Imported rice is too expensive for the rural population. Senegal's **rural population** appears **more or less self-sufficient** in rice. No doubt there is scope for increased production to improve food security, and perhaps there is demand to replace other cereals, too (that market research is not covered here, if indeed it has been done by others). Note that there is an export trade in surplus rice. Among the urban population, the reverse is true: An estimated 27,000 tons of white rice from local producers reaches the urban population, amid 800,000 tons of imported rice, suggesting a self-sufficiency figure of about 3.5 percent. In fact, for the urban population, the question is not so much related to self-sufficiency as it is related to a substantial market opportunity.

³⁰ See http://www.investinsenegal.com/apix_anglais.html.

In this case, continued expansion of rice production without taking the end market into account is counterproductive. Unless the incremental production can reach the urban consumer, it will only flood rural markets and will not substitute for the imported rice consumed in urban areas. A rapid increase in output will be destabilizing. Without adequate storage, the benefits of improved food security will be lost, and a negative impact on prices can be expected at some point.

To succeed, the planned increment in rural production must match demand from urban consumers. Producers will need to meet an assortment of quality criteria, intrinsic (flavor, or possibly fragrance, considering that one-third of imports consists of high-grade jasmine rice) and extrinsic (cleanliness, homogeneity, other food preparation traits, packaging, branding, continuity of supply, and price). But beyond doubt this market opportunity is valuable. A market price (Figure A1.22) of CFA 250 per kilogram suggests a retail market valuation of imported rice around US\$ 385 million.

The benchmarking of costs in the Senegalese rice value chain against those of Thailand shows that rice producers in the Senegal River Valley should be able to compete with Thai producers, although subsidies confuse the picture. Domestic resource cost calculations in earlier reports have made essentially the same point. Three new aromatic rice varieties were planted in 2011 in Senegal. The production costs for those varieties are not radically different from those for traditional white rice varieties, although their yields may be different (data on the harvest are not yet available). It remains to be seen if the new aromatic varieties can match Thai rice and begin to substitute for it in the Senegalese rice market.

Penetrating the rest of the market—the two-thirds of the market for imported rice that demands plain, white, 100 percent broken or whole rice—will be more challenging. Note how Thai exports for this segment of the market have dropped under pressure from more competitive supplies from Vietnam and South America.

To capture a share of the urban rice market currently occupied by imports requires a good understanding of the market. Recent initiatives to identify consumer preferences for rice through focus groups and experimental auctions will help to give direction to the plant breeding strategy, but a strategy for supplying the market is also required. PINORD's successful pilot of the Rival brand will be difficult to scale up from such a fragmented base.

Scale is a key dimension in supplying an urban market where rice currently arrives by the boatload rather than the truckload. Achieving scale in the rice sector will require entrepreneurial investment. For example, a consolidator may install a larger mill (as is happening slowly) with storage capacity; a producer, once established, could contract with outgrowers. It is difficult to see how this consolidation will happen in a directed way without the involvement of private investors. In this respect, the inclusion of APIX in the GOANA project is highly appropriate.

Ghana

Overview

Rice is produced across Ghana but is more concentrated in the Upper East Region near the border with Burkina Faso, the Northern Region near Tamale, and the Volta Region around Hohoe and Kpandu (Figure A1.23). Other focal points for production are found around irrigation schemes, as in Ashanti Region, but their output is less significant.



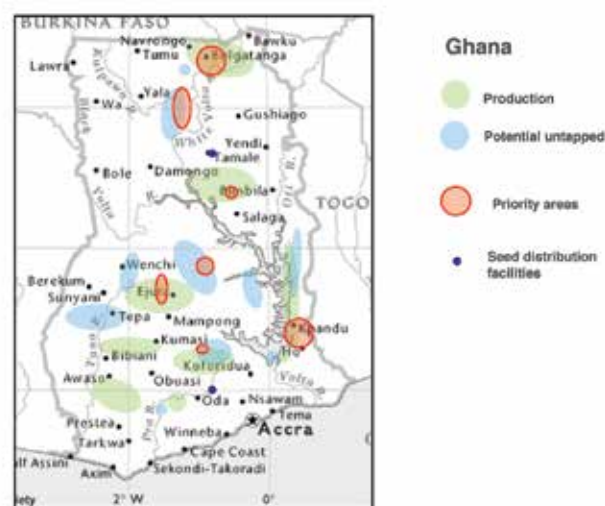
The Ministry of Food and Agriculture (MoFA) reports that Ghana produces 492,000 tons of paddy (2010) (Table A1.8), and government data show that production is increasing. The paddy production figure is widely held to be greatly overestimated, but the reality is that national rice output is not known. The lack of reliable statistics confounds the formulation of a strategy either for increasing output or food security.

Ghana has several main rice farming systems: lowland rainfed, including inland valley systems (78 percent of production); upland rainfed (6 percent of production); and irrigated (16 percent of production). Yields of rainfed paddy average 1.0–2.4 tons per hectare, and irrigated rice yields average 4.5 tons per hectare (Osei-Asare 2010).

Irrigated agriculture is currently developed through 22 government-funded irrigation schemes. These schemes have a potential area of 12,528 hectares, of which 7,378 are currently developed (Table A1.9) (Osei-Asare 2010). Ghana's total potential for irrigated agriculture is thought to be 1.9 million hectares, roughly 0.46 percent of which is currently developed. The greatest potential lies in the expansion of irrigation infrastructure along the Volta and its tributaries, where a number of small- and medium-scale rice producers operate and two larger facilities have been developed (Prairie Volta Ltd., formerly Quality Grain Rice Company, and GADCO).

Area planted to rice in the inland valleys has increased during the last two decades or so, but these areas remain underused³¹ despite their considerable potential. The Crops Research Institute believes that the focus of the Food and Agriculture Sector Development Policy on the large flat areas in the North should be complemented by development of the inland valleys for rice production. The small plots and sloping terrain preclude large-scale mechanization in these areas, yet scope exists to

Figure A1.23: Rice in Ghana: Current and potential production areas



Source: National Rice Development Strategy.

Table A1.8: Total availability of rice in Ghana

	2009/10	2010/11	2011/12 (Est)
Area harvested (000 ha)	162	180	
Paddy (000 t)	392	492	517
Milled (000 t)	235	295	310
Imports (000 t)	382	320	330
Consumption (000 t)	600	610	620
Ending stock (000 t)	84	89	109

Source: USDA GAIN Report 2011.

³¹ An AfDB survey in 2001 estimated utilization at 20 percent.

Table A1.9: Progress in developing irrigation schemes for rice

Location	Potential area (ha)	Developed area (ha)	Irrigation system (G = gravity; P = pumping scheme)	Major crops cultivated
Ashiaman	155	135	G	Rice
Dawhenya	450	191	P+G	Rice
Kpong	3,028	1,400	G	Rice and vegetables
Afife	880	880	G	Rice and vegetables
Aveyime	280	60	P+G	Rice
Okyereko	100	40	P+G	Rice
Nobewam	150	120	P+G	Rice
Bontanga	450	450	G	Rice and vegetables
Golinga	40	26	G	Rice
Kikam	27	27	P+G	Rice
Tono	2,400	2,400	G	Rice and vegetables
Vea	1,000	1,000	G	Rice and vegetables

Source: Adapted from Osei-Asare (2010).

increase the efficiency of production by mechanizing transplanting and harvesting. Mechanization is crucial because of the scarcity and high cost of labor during these periods in the cropping cycle.

Markets and consumers

Per capita rice consumption was 20–25.8 kilograms per capita for 2009/10. According to the *Ministry of Food and Agriculture Facts and Figures Report* (2009/2010), urban markets represent about 76 percent of total rice consumption, but only 20 percent of locally grown rice is consumed in urban areas, with the rest consumed in rural areas.

A key characteristic of the Ghanaian rice value chain is that rice produced in the north (in the Northern and Upper East Regions) is consumed locally. This rice is parboiled and generally considered inferior in terms of cleanliness, flavor, and cooking characteristics. The rice produced in northern Ghana does not reach Accra in commercially significant quantities and is rarely found for sale as far south as Kumasi. Conversely, limited quantities of imported rice reach the far north but do not achieve volume sales in the markets, although in Tamale imported rice is reportedly becoming more popular with a rising middle-income population.³² In the vicinity of Kumasi, in Ashanti Region, locally produced rice competes more directly with imported rice, but local rice is available in relatively small volumes. In Accra, almost all rice in the markets and shops is imported, although rice from Volta Region is available in specialized stores.

The published figures of rice self-sufficiency of 30–40 percent are misleading. The annual production of local rice that is marketed and distributed amounts to probably not more than 50,000

³² Osman Gyasi, World Bank, personal communication.



tons of milled rice,³³ compared with imports³⁴ of 350,000–380,000 tons of milled rice per year, which suggests that self-sufficiency is below 13 percent. The substantial production of rice in northern Ghana is not relevant to this calculation because it is consumed locally and does not compete with imported rice.

Aromatic rice varieties are quite widely grown now; their presence seems to be a recent development. Jasmine 85 and Togo Marshall are found in Northern Region, Ashanti Region, and Volta Region. It is not known if aromatic rice is cultivated in Upper East Region.

Imported rice is expensive. In July 2011, a 25-kilogram bag of Thai aromatic rice, retail, was sold at GHS 65,³⁵ equivalent to US\$ 43. With a monthly salary for a middle-income earner in Accra at about US\$ 200/month, rice purchases account for a substantial portion of household income.

The Ghanaian rice market is made up of a number of well-known brands. Unusually for West Africa, where rice tends to be treated as a basic commodity, rice brands in Ghana are promoted, and marketing is backed by advertising campaigns. Significant brand value is attached to imported rice generally, and to some extent the drivers of consumer preferences are those already mentioned—cleanliness, cooking quality, flavor/fragrance, and also status.

Ghanaians prefer long-grain rice from the United States, despite the fact that it is often one of the highest priced types on the market, because of its high quality and taste (GAIN 2011). Aromatic, long-grain white rice from Thailand competes strongly with rice from the United States, but it is preferred mostly by the highest-income consumers. As a result, rice imports from the United States, Thailand, Vietnam, India, China, and Pakistan have all risen considerably to meet Ghana's increasing demand. Table A1.10 lists imported aromatic brands found in the Ghanaian marketplace, along with their market share (Diako et al. 2010).

Surveys in Accra indicate that 71 percent of respondents admitted that they do not purchase local rice, nor do they know of any local brands (Diako et al. 2010). Nearly 70 percent of Accra consumers consume rice more than eight times a month, purchasing rice in bags of 5–50 kilograms. Nearly all consumers have purchased aromatic rice, and 71 percent do not purchase local rice because of its poor quality and limited availability on the urban market. Larger households generally tend

Table A1.10: Imported rice varieties and their market share in Ghana

Variety	Market share (%)
Sultana	30.2
Royal Feast	24.5
Tiger	17.2
Savannah	4.3
Phoenix Jewel	4.3
Neat	3.6
Special Lady	3.6
Uncle Bob	2.2
Gino	2.2
Sunbird	1.8
Other	6.1

Source: Diako et al. 2010.

³³ Of this, only a portion is marketed directly against imported rice.

³⁴ Including “cross-border” trade.

³⁵ GHS = Ghanaian new cedis. US\$ 1 = GHS1.5.

to buy local rice to save some money. The three most critical attributes of cooked rice preferred by consumers, and which they normally use to judge rice quality, are taste, aroma, and texture. Consumers are more concerned about a positive appearance (absence of black specks, uniformity of grains, absence of chalkiness and foreign material) of the raw rice than the grain size, grain length, and color.

Local production

Land. Only 5 percent of Ghanaian farmers grow rice. Of these, about 60 percent are net sellers (Table A1.11).

A fundamental issue in developing the rice sector is land tenure. Land tenure regulations must protect smallholders' interests while offering opportunities for large-scale investment in rice production. The topic is large, complex, and rooted in emotion; it has a long history of debate. Briefly, Ghana has two major classes of land tenure: customary land and public land. Customary land is held by chiefs, family, or group heads, for the benefit of that group. Public land, acquired by outright purchase or inherited from colonial days, is held by the state for public use.

Title to customary land is held by the chief or family head, and the land is made available through a transfer of the rights to profit from the output of the property. Such rights can be acquired through various arrangements, such as tenancy, lease, share contracts, and loans, but ownership of the land remains with the chief or family head. About 80 percent of rural land in Ghana is held by customary authorities.

Customary law evolves: It adapts with cultural interactions, population pressures, socio-economic change, and political developments (including conflict), and not all systems evolve simultaneously. As a result, the customary systems may vary across Ghana.

The secondary, or derived, rights to cultivate the land can be inherited or traded, and so an increasingly complex network of entitlements has arisen that has not necessarily been recorded but will often extend to parties who have long since moved away. The potential investor is faced

Table A1.11: Profile of rice farmers in Ghana

Ultra-poor rice growers	Subsistence producers, in households often headed by women or the elderly. Face labor constraints; have no resources to rely on in the event of external shocks.	15%
Marginal rice smallholders	Could produce a small marketable surplus; may have some resources on which to rely (such as greater physical strength, better health, more land, small savings, and so on). Significant proportion of adult household members may migrate during the off-season.	25%
Viable small-scale rice growers	Poor but potentially viable small scale farmers. Not necessarily factor constrained (have land and/or labor). Often have assets that are used inefficiently because of lack of access to markets, poor infrastructure, or weather-related risks. Limited access to technologies. Willingness to take some risk.	40%
Emergent commercial rice growers	Grow rice mainly as cash crop; market orientation; could own small equipment like tractors; use hybrid seed and fertilizer; few with irrigation; have household labor with some hired labor.	20%

Source: National Rice Development Strategy 2009:26.



with the task of identifying all those holding primary and secondary rights within the boundaries of the plot of interest. In remote areas this may be less difficult, although there might still be complicating pastoral rights. In the more populous areas, the issues multiply.

Problems with the land sector in Ghana include:

- Indiscipline in the land market—including encroachment, multiple sales of the same plot, unapproved development, and spurious claims to title/deeds.
- Costly and time-consuming legal support services.
- Lack of scrutiny and accountability—the constituents of a group may not be consulted, while the customary authorities gain personally.
- Land administration services that are confronted with a huge organizational task.
- An increasingly landless population, which inevitably politicizes the acquisition of land.
- Underlying issues behind these problems include:
 - Uncertain boundaries—with no cadastre for reference and outdated deeds and/or titles.
 - History of acquisition: Compulsory state acquisition of land may not have been compensated or may have left the autochthonous communities landless.
- Rules of customary tenure are not fully codified but are complex, extensive, and may vary between local authorities.

Clearly land tenure issues have to be addressed if large-scale, nongovernmental initiatives are to progress with minimal risk and disruption, both to private investors and local communities.

Land rents, leases, and values vary throughout the country depending *inter alia* on location, pressure on the land, resources, and current use. The structure of the rental payments may vary with time, and the scale of development will also have an impact. The recent investment by GADCO involved a negotiated agreement to share the sales proceeds in lieu of rent, giving the local community a direct interest in the venture's success.

Water management. Table A1.12 describes rice production systems by type of water source and water management. Most small irrigation schemes perform relatively poorly. Such schemes tend to have limited ownership by local farmers, and the infrastructure is often allowed to degrade

Table A1.12: Ghana's rice production systems by type of water source and water management

System	Water source	Water management	Crops per year	Potential productivity per season	Proportion of Ghanaian production ^a
Upland	Rainfed	Limited	Single	0.5–1 t/ha	6%
Lowland	Rain/river	Bunds/catchment	Single	0.5–1.5 t/ha	78%
Inland valley	Rainfed	Use of bunds + topography and soil water retention	Single	Up to 3 t/ha	
Irrigated	Irrigation	Managed	Double	6 t/ha	16% max

Source: Authors

^a JICA (2007).

once the project period ends. The resulting poor drainage creates problems with land preparation in the rainy season. Farmers often prepare land inadequately, broadcast seed late, and encounter problems with drought near the end of the cropping cycle.

Finance. In Ghanaian agriculture, finance is provided by the Agricultural Development Bank and the rural banks. Most smallholder rice farmers have considerable difficulty obtaining any formal credit and rely mostly on their own resources or informal credit extended between immediate links in the value chain.

Seed supply. The National Rice Development Strategy identifies the need to scale up rice seed production to meet targets for increased rice production, but it recognizes that gaps prevail in the production and supply of quality rice seed (Table A1.13). The current rice seed system is weak. Chal-

lenges remain in introducing and testing new rice varieties, managing nationwide seed production and distribution, and developing seed storage infrastructure. Foundation seed is produced by appropriate research institutes and centers under the Council for Scientific and Industrial Research and the University of Ghana, respectively, through funded projects. The bulk of certified rice seed is then produced by licensed private seed growers under appropriate supervision by the Plant Protection and Regulatory Services Directorate of MoFA and the Grains and Legumes Development Board. The current system is deemed unable to produce the right quantity and quality of rice seed to implement the government's strategy. The introduction of the aromatic varieties Jasmine 85 and Togo Marshall is an interesting development, however, given that these varieties have gained some market acceptance within an apparently short time.

Chemical. To encourage greater use of fertilizer across all agricultural sectors, the government has been operating a subsidy system since 2007. This policy is a response to the minimal use of fertilizer in rice due to its high cost, resulting in low productivity. In the 2011 farming season, the government announced subsidized prices of GHC 30 per 50 kilograms of NPK fertilizer (the normal price was GHC 50); GHC 29 for urea (versus GHC 51); and GHC 25 for ammonium sulfate (versus GHC 40).

A recent review of the program (Yawson et al. 2010) highlights the following issues:

- Considerable improvement is needed in the distribution of coupons and fertilizers to ensure higher effectiveness of fertilizer and to make farmers' participation in the program more sustainable.
- Fertilizer is not available at key production points.
- Price and nonprice factors combine to constrain access to subsidized fertilizer.
- Few farmers actually benefited from the subsidy program.

Labor and mechanization. The availability of agricultural equipment is quite limited. It is estimated that 40 percent of farmers overall in Ghana use some form of mechanization, mostly in land

Table A1.13: Projected rice seed requirements

Year	Area (ha)	Total (t)
2008	126,290	5,661
2013	173,130	10,175
2018	375,000	18,750

Source: National Rice Development Strategy, 2009.



preparation. Power tillers are quite widely available; in some areas tractors and even some combine harvesters are available as well. The Crops Research Institute is promoting the sawah system, which it regards as more sustainable: Rotavators are used to level land, and irrigation water flows through networks of interconnected, banded fields. Power tillers (costing about 3,700 GHS are imported through the KR22 facility. They can be purchased at approximately twice this price on the open market. One power tiller can cover up to 2 hectares in a day.

Commercialization. The proportion of the crop sold varies widely. At one end of the spectrum are the commercial farms that sell all of their output; at the other end are subsistence farms that rely on their harvest for feeding the family.

The number of traders is very large, and few have the capacity to deal in substantial volumes. Generally, farmers sell paddy rice, although farmers in Ashanti Region tend to sell milled rice. In northern Ghana rice, is parboiled before milling. Whole grain white rice is preferred in this area, and parboiling improves the milling yield of whole grains. As mentioned, parboiling is necessary as the rice is very dry (<14 percent moisture content) by the time of milling and liable to break.

Milling. The number of rice mills operating in Ghana is not known, but numerous small mills operate throughout the producing areas. Most operate as a service and are unable to de-stone or grade. They do not buy or sell rice, and the service fee makes no distinction for the quality of the output. The significant mills include:

- *Prairie Volta* at Aveyime (Volta Region) is the largest mill in Ghana with a capacity of 10 tons per hour. Underproduction on the farm and limited local supply causes the mill to be severely underused. The shortage of capital and the inability to use an AfDB credit facility for operating costs further constrains the mill's performance.
- *Brazil Agro Investment Ltd* at Dabala (Volta Region) is a new (2011) mill established by a Brazilian farming operation. Capacity is thought to be 5 tons per hour. The mill was not yet operating in July 2011, but it was thought that with the harvest approaching it would soon be running.
- *Worawora Rice Mill Ltd* at Worawora (Volta Region) dates from 1974 but was refurbished in 2002 with assistance from the NGO TechnoServe. Potential throughput is 2 tons per hour, but there is insufficient local production to fully use the mill.

Distributed throughout the Volta and Northern Regions are perhaps 15 smaller mills capable of processing around 1.5 tons per hour. The state of the mills and the availability of supplementary equipment (de-stoners and sieves, for example) varies. In the North, these mills are associated with irrigation projects (Nasi, SARI, ICOUR). Generally the technology is based on rubber rollers that will give a higher yield than the steel rollers typical of small village mills.

Distribution. Rice bought as paddy and then milled (perhaps after parboiling) or bought as white rice from the farmer is acquired by a variety of traders. Some are simply intermediaries acting as buying agents. Others may supply local markets directly or, if they have the resources, supply more distant markets. In this way, surplus areas provide rice to areas of unfulfilled demand. As indicated, only limited amounts of local rice reach Accra, mostly from Volta Region. The more



remote producing areas supply nearby markets. Even if markets such as Accra had greater demand for local rice from these distant production areas, it would not be available.

Linkage. As the previous discussion indicates, the rice-producing sector in Ghana is fragmented. Neither strong horizontal or vertical linkages give the sector cohesion. The irrigated areas, of necessity, have farmer associations to manage water resources. Producer groups are found elsewhere, but vertical linkages are rare.

Two recent and ongoing public-private sector partnerships highlight the opportunities for a more market-led, linked approach. The first, a rice agri-business cluster in Upper East Ghana, has been formed between the Single Mothers Association (SMA) (an NGO) and a group of 450 farmers, who have formed a Rice Farmers Coalition (Anon. 2009). SMA, as part of its need to generate revenue, has set up an agri-business to buy and process paddy and sell parboiled rice. Government institutions have been encouraged to buy the rice from SMA at a price that is guaranteed to be higher than the average price of imported rice. This arrangement has provided the farmers with an incentive to expand farming area, purchase improved seed (the Jasmine variety) and fertilizer, and hire plowing services. With increased prices and sales volumes, farmers can purchase inputs with cash.

A second initiative, again featuring a guaranteed buying price, has been set up between rice farmer associations and the Continental Commodities Trading Company Limited, a subsidiary of the Finatrade Group. Continental agreed to provide a guaranteed market for perfumed local rice produced by farmers in Hohoe municipality and surrounding areas. The rice, packaged under the brand name “Pride,” is produced in partnership with ACDI/VOCA, the implementing agency of the Millennium Development Authority (MiDA). Quality is maintained by having the paddy milled by Prairie Volta. Consumer response was good, but without continuity of supply and insufficient volumes, it has proved difficult to keep Pride rice visible in the market.

As an apex organization, the Ghana Rice Inter-professional Body was formed by a French-funded development project in 2004. The organization has some 9,000 members who are represented by group leaders from farmer-based organizations, mills, trader, parboilers, and so on. It provides a forum for discussing constraints and interventions and provides a mechanism for linkage and advocacy as well as carrying out its own studies and providing training.

Institutional support. In the last decade, the rice sector has been supported by various ongoing and completed rice-related development projects implemented by MoFA and donor partners (Table A1.14).

Donor support for these programs has been estimated at approximately US\$ 63 million. In addition, the World Bank is planning to provide a proposed third Agricultural Development Policy Operation (AgDPO 3) as a single-tranche credit for US\$ 57 million equivalent intended to help the Government of Ghana implement the Medium Term Agriculture Sector Investment Plan.

Imports

Origins. Ghana’s rice imports are around 350,000–380,000 tons per year. A range is given because a certain amount is imported unofficially from Côte d’Ivoire. Overall volumes of imports, official and unofficial, are relatively stable (Figure A1.24).



Table A1.14: Recent development projects in Ghana with a rice component

Title	Duration	Location	Funding agency	Value
Food Security and Rice Producers Organization Project	2003–08	Northern Region	AFD	€ 1.4 m
Special Programme for Food Security in Ghana	2002–07	Various	FAO	US\$ 1.26 m
Project for Promotion of Farmers' Participation in Irrigation Management	2004–06	Irrigated areas	JICA	¥ 250 m
Study on the Promotion of Domestic Rice in the Republic of Ghana	2006–08	Countrywide	JICA	¥ 160 m
Small Scale Irrigation Development Project	2001–09	Countrywide	AfDB	UA 15 m
Inland Valleys Rice Development Project	2004–09	Various	AfDB	UA 15 m
Improvement of Drought Tolerance of Rice through Within-Species Gene Transfer	2007–09	Tamale	AGRA	US\$ 35,000
Small Farms Irrigation Project	2003–09	Countrywide	BADEA	US\$ 9.5 m
Nerica Rice Dissemination Project	2005–10	Northern, Ashanti, Volta	AfDB	US\$ 3.67 m
Rice Seed Production	2008–10	Upper East, Upper West, Northern	AGRA	US\$ 150,000
Ghana Rice Inter-professional Body	2008–12	Upper East, Upper West, Northern, Volta	AFD	€ 0.14 m
Rice Sector Support Project	2008–14	Upper East, Upper West, Northern, Volta	AFD	€ 17.3 m
Project for Sustainable Development of Rainfed Lowland Rice Production	2009–14	Northern, Ashanti	JICA	US\$ 3.6 m
Development of Low-input Rice Cultivation System in Wetland in Africa	2009–15	Ashanti	JIRCAS	¥ 150 m
An Emergency Initiative to Boost Rice Production	2008–10	Upper East, Upper West, Northern	USAID	US\$ 1.27 m
Improving Organic Matter Content of Soil for Increased Yield of Nerica	2006–11	Volta	FARA	US\$ 30,000
Development of Rice Varieties with Enhanced Nitrogen-Use Efficiency and Salt Tolerance	2010–15	Ashanti	USAID	US\$ 80,000
Improving Yield, Quality, and Adaptability of Upland and Rainfed Lowland Rice Varieties in Ghana to Reduce Dependency on Imported Rice	2009–12	Volta	AGRA	US\$ 185,000

(continued on next page)



Table A1.14: Recent development projects in Ghana with a rice component (*continued*)

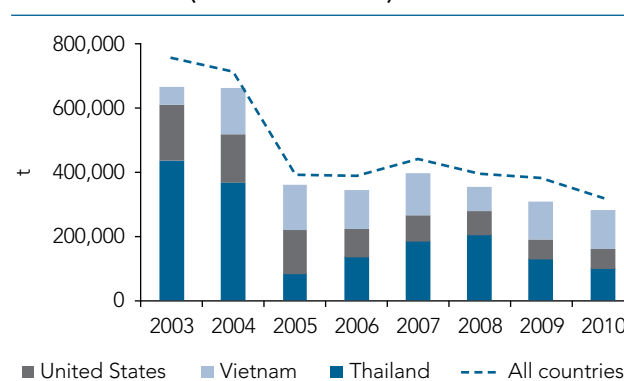
Title	Duration	Location	Funding agency	Value
Expanded Rice Programme	2008–ongoing	National	Government of Ghana	
Dissemination of Improved Rice Production Systems with Emphasis on Nerica to reduce Food Deficit and Improve Farmers' Income in Ghana	2011–14	Various	UN Human Security Fund	US\$ 970,000

Source: Osei-Asare 2010.

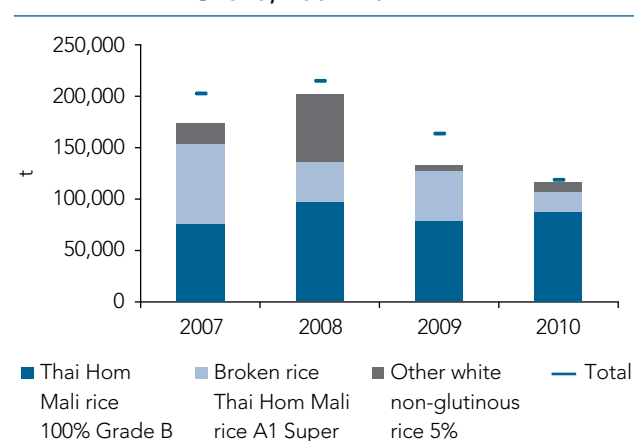
Note: AFD = Agence Française de Développement; AfDB = African Development Bank; AGRA = Alliance for a Green Revolution in Africa; BADEA = Arab Bank for Economic Development in Africa; FARA = Forum for Agricultural Research in Africa; JICA = Japan International Cooperation Agency; JIRCAS = Japan International Research Center for Agricultural Sciences; USAID = US Agency for International Development.

The proportion of perfumed rice that Ghana imports now exceeds the share of long-grain white rice (51 percent to 49 percent) (Figure A1.24). The perfumed rice is mostly of Thai origin, but imports of fragrant rice from Vietnam are increasing annually. About 44 percent of the long-grain white rice is imported from the United States (US No. 2 or No. 4), and 44 percent is from Vietnam (5 percent broken). The amount of Thai (5 percent) is declining annually, as is the amount of 25 percent broken from other origins. The market is therefore consolidating across three export origins (Thailand, Vietnam, and the United States) and fairly superior grades.

Demand for Thai rice is consolidating in the higher-grade Hom Mali, and imports of Thai white rice have declined (Figure A1.25) in the face of more competitive supplies from Vietnam and the Americas. The lower (broken) grades of Hom Mali are declining, probably to be replaced by

Figure A1.24: Rice imports to Ghana, 2003–10 (official statistics)

Source: COMTRADE data.

Figure A1.25: Exports of rice from Thailand to Ghana, 2007–10

Source: Thai Customs Authority.

Pathumthani, but the unbroken Hom Mali remains in good demand. This is not top-quality Hom Mali but remains a premium product.

Importers. A few large-scale importers dominate the market. Particular players are Finatrade (linked to Louis Dreyfus), Olam, CIC, Stallion, and Novel. The importers tend to purchase through the international trade, but they may also deal directly with mills in Thailand. A large number of smaller importers will bring in rice by the container load as the opportunity arises. Rice arrives in Ghana in 50-, 25- and 5x5-kilogram bags. The smallest bags are used for top-end brands.

Tariffs and duties. The value of a bag of rice rises dramatically on import with the application of duties and levies. These amount to an addition of 40 percent to the CIF value (Table A1.15). As noted, these rates apply to all forms of rice—milled, brown, or paddy. VAT is applied only to imported rice and not locally produced rice.

Neighboring Côte d'Ivoire applies an import duty of 12.5 percent with no VAT or National Insurance and Export Development and Investment Fund Levy. This practice explains the 22.5 percent differential in landing costs between Côte d'Ivoire and Ghana and encourages smuggling. Estimates of the amount smuggled vary from 25,000 tons to more than 100,000 tons, although the lower end of the range is more likely.

Distribution. After clearing the port, the importers hold the rice in their warehouses in Tema or Accra. The wholesalers/distributors come to the warehouse to buy and then move the rice to their own stores located near the markets. In turn, retailers visit the wholesale stores to buy smaller volumes that are then marketed to the consumer through shops and markets.

Costs. Margins along the chain are not great, with a maximum of 2–3 percent perhaps at the retail stage. Transport to Kumasi will add GHS 1.5 per 50 kilograms (US\$ 20 per ton) to the value of the rice. For the higher-value grades, this sum is not so significant.

Market prices

The wholesale price of a 50-kilogram bag of rice depends on the grade (from Grade 1 to 70 percent broken):

- The price of United States rice ranges between GHS 80 (US\$ 53.33) and GH¢100 (\$66.66).
- Thai rice ranges between GH¢ 120 (US\$ 80) and GH¢ 150 (US\$ 100).
- Chinese rice ranges between GH¢ 60.00 (US\$ 40) and GH¢ 70 (US\$ 46.6).

Table A1.15: Tariff of duties and levies on rice imports to Ghana

	Rate	Applied to
Import duty	20.0%	CIF
VAT	12.5%	CIF + Duty
National Health Insurance Levy	2.5%	CIF
Export Development and Investment Fund Levy	0.5%	CIF
Inspection Fee	1.0%	CIF
ECOWAS Levy	0.5%	CIF
Ghana Customs Network	0.4%	CIF

Source: Ghana Revenue Authority and importer interviews.

Note: ECOWAS = Economic Community of West African States.

Data from price/market studies by Minot (2010) showed price transmission in Ghana markets using data for 2007/08 from FAO. Only Kumasi shows a significant relationship with the world rice price (Table A1.16). Table A1.17 lists typical retail prices in Accra in late July 2011. By comparison, prices noted in Kumasi at the same time are listed in Table A1.18.

The variation in pricing is quite evident. Unfortunately, government market price gathering, which covers 16 different urban markets, distinguishes only between local and imported rice for milled rice prices and only lately has begun recording perfumed and nonperfumed rice prices. As is clear from the data in the tables, however, there is substantial variation by grade and brand. Strong branding is a feature of the Ghanaian rice market, with sophisticated consumers identifying with particular brands that are promoted.

Government strategy

Underlying strategy. Rice is considered to be the second most important staple crop after maize. The Government of Ghana has developed the Medium Term Agriculture Sector Investment Plan

Table A1.16: Comparison of rice prices in different market locations in Ghana

City	Commodity	Mean price (US\$/t)	Minimum price	Maximum price
Accra	Imported rice ^a	370	283	429
Kumasi	Imported rice	372	285	456
Tamale	Imported rice	334	243	650
Techiman	Imported rice	341	224	491
Kumasi	Local rice	734	412	832
Tamale	Local rice	438	310	528
Techiman	Local rice	500	343	597
Average world price		210	122	772

Source: Adapted from Minot 2010.

^a Thai Super A1 broken white rice.

Table A1.17: Rice retail prices, Accra, July 2011

Origin	Grade	GHS /unit	US\$ /kg
Thailand	Hom Mali	62–65 per 25 kg	1.65–1.73
Vietnam	Perfumed	45–46 per 25 kg	1.20–1.23
Thailand	5%	69 per 50 kg	0.92
Vietnam	5%	67–68 per 50 kg	0.89–0.91
United States	No. 2	80 per 50 kg	1.07
United States	No. 5	78 per 50 kg	1.04
Vietnam	25%	63 per 50 kg	0.84
Volta Region, Ghana	Rema, Jasmine	12 per 5 kg	1.6

Source: Authors' data collection

Table A1.18: Rice retail prices, Kumasi, July 2011

Origin	Brand	GHS/unit	US\$ /kg
Thailand	Sultana	14 per 5 kg	1.87
	Sultana	68 per 25 kg	1.81
	Royal Feast	13.5 per 5 kg	1.80
	Special	49 per 25 kg	1.30
	Royal Orchid	63 per 25 kg	1.68
	Hom Mali	65 per 25 kg	1.73
	Red Dove	66 per 25 kg	1.76
	Lele	70 per 25 kg	1.87
United States	Texas Star	11 per 5 kg	1.47
	Texas Star	52 per 5x5 kg	1.39
	Texas Star	42 per 25 kg	1.12
	Texas Star	79 per 50 kg	1.05

Source: Authors' data collection

to implement the objectives of the second Food and Agriculture Sector Development Policy over the medium term (2011–15).

The plan aims to raise the self-sufficiency level of rice to 75 percent by 2015 through an increase in the competitiveness of domestic producers in the local and international markets based on fair

Table A1.19: Production targets for rice production systems

System, area, yield, and production		System targets		
		2008	2013	2018
Rainfed upland	Area (000 ha)	7.1	30.0	45.0
	Yield (t/ha)	1.5	2.2	2.5
	Production (000 t)	10.6	66.0	112.5
Rainfed lowland	Area (000 ha)	92.0	150.0	300.0
	Yield (t/ha)	2.5	3.0	3.5
	Production (000 t)	230.1	450.0	1,050.0
Irrigated	Area (000 ha)	18.9	25.0	30.0
	Yield (t/ha)	4.0	5.0	6.0
	Production (000 t)	75.5	125.0	180.0
Total/average	Area (000 ha)	118.0	205.0	375.0
	Yield (t/ha)	2.7	3.3	4.0
	Production (000 t)	318.6	676.5	1,500.0

Source: Adapted from National Rice Development Strategy 2009.

and equal competition. It also aims to have an import and domestic trade regime that promotes consumer protection through fair prices, range of goods, and acceptable quality of goods.

To meet the expected growth in demand to 1.5 million tons of rice by 2018, the Rice Strategy has projected the need for significant increases in productivity and area of production in each of the three main farming systems (Table A1.19).

Implementation. MoFA has developed a rice subsector strategic plan, derived from the second Food and Agriculture Sector Development Policy, which focuses on seven thematic areas:

1. Seed production system, with varietal improvement program.
2. Fertilizer marketing and distribution.
3. Post-harvest handling and marketing.
4. Irrigation and water control investment.
5. Increase mechanization, equipment access, and maintenance.
6. Research and technology dissemination.
7. Community mobilization, farmer-based organizations, and microcredit management.

In support of implementing the strategy for growth, the government has launched a number of initiatives and introduced supporting legislation, including:

- The introduction of a government-run buffer stock program to achieve price stabilization and disaster preparedness, including guaranteed (floor) prices for farmers.
- Development of a commodities exchange and warehouse receipt system that will: (1) provide a marketplace for farmers; (2) encourage stockholding; (3) stimulate trade; (4) improve market transparency and price discovery; and (5) provide collateral to leverage commercial credit.
- Development of an irrigation policy that emphasizes the role of private, nonstate actors in the development and management of large- and small-scale irrigation schemes, which is important if irrigation is expected to play a pivotal role in increasing productivity and supporting agricultural development in Ghana.
- The creation of public-private sector partnerships, as part of the Commercial Agriculture Programme, to promote large-scale, capital-intensive irrigation ventures.
- Subsidy scheme to supply fertilizers for smallholders.
- Development of a combined seed and fertilizer package for smallholders.

Conclusions

Key elements to developing commercial value chains for domestic rice are: (1) achieving the quality that is needed in the different market segments (which to a large degree is a question of improved milling); (2) the transformation of land tenure systems to permit the private investments in irrigation infrastructure that are critical for commercial rice production; (3) the introduction of rice varieties with new genetic potential to grow in poor soils; (4) attracting investment from larger firms that can direct the supply chain (for example, importers shifting to making investments in



milling); (5) removing the impediments to business to allow the existing and sufficiently large base of experienced rice farmers to drive supply growth.

A large number of donor-funded projects have attempted to improve productivity and overall production levels through various approaches and with varying degrees of success. For example, earlier projects such as the Nasia Rice Company project at Tamale had a strong focus on improving productivity but gave little attention to quality and developing market linkages and access. Although subsequent attempts have tried to rectify this omission, quality is still problematic, and price fluctuations mean that farmers do not always honor contracts, with consequences for loan recovery and trader confidence.

AfricaRice highlights two key areas for improving the quality of local rice:

- To enhance the market value and appeal of locally produced rice, it will be necessary to improve the appearance, cleanliness, and homogeneity of grains, which will require rice farmers to adopt better harvest and post-harvest paddy handling practices.
- Rice millers attributed the difference in the quality between locally milled rice and imported milled rice to the type of processing technologies and the need for improved equipment, which was difficult to purchase because credit and sufficient throughput of locally produced paddy were lacking.

In the final analysis, rice in Ghana is segmented into two virtually separate target markets of local rice and imported rice. There is limited overlap between the two products in terms of geographic markets, but imported rice is increasingly penetrating the urban markets of northern Ghana, while the adoption of fragrant varieties by growers nearer Accra gives consumers in the capital access to those varieties. Until the quality of local rice can match the quality of imported rice for such criteria as cleanliness, uniformity, taste, and swelling, with a reliable supply backed by promotion, imports will continue, and the imported rice market will remain largely inaccessible local producers.

Benchmarking

Introduction

Benchmarking is a management tool that enables organizations to examine their performance critically, in order to adopt better practices from organizations held to be market leaders. It is a systematic method by which an organization can measure itself against best practice. Armed with an appraisal of its comparative performance and strengths and weaknesses, the organization can then implement changes that confer a competitive advantage.

The primary advantage of benchmarking is that it gives a clear understanding of the organization's own processes, and measurement of those processes allows for planned improvements. But benchmarking is also a relative appraisal; it allows the comparison to market leaders and the adaptation of practices from competitors in place of in-house invention, thereby saving time and



money. In that it can be multi-dimensional, benchmarking allows the comparison of many different performance measures.

In the West African rice value chain, imports dominate local production. Despite the costs of trading, freight, and duty, imported rice still outcompetes locally grown rice in Senegal and Ghana. If local rice is not competing, it would seem that benchmarking Ghanaian and Senegalese rice against an industry leader might point to efficiencies and adaptations that could make West African rice better able to compete.

Methodology

Objectives and design

The study sought to gain new insight into the potential competitiveness of and constraints affecting the rice industry in Ghana and Senegal by benchmarking it with Thailand's rice value chain. The analysis of imports presented in Chapter 2 shows the extent to which Thailand supplies rice to Ghana and Senegal. Thailand has long led global exports of rice, and although the Thai rice sector may not lead the industry in production,³⁶ its ability to compete on the global market is clear. Table A1.20 lists the areas chosen for the study.

Two considerations guided the approach:

1. *A number of elements determine competitive capability.* The relative positioning of the country rice value chains requires an evaluation of the various elements, which include costs; innovation (commercial, institutional, technological); management; professionalism; social capital; institutional support; market access; and the enabling environment/government policies. A range of interviews is needed to understand those elements, not simply with the private sector principals in the value chain but also with supporting players. The formal and gray literature must be reviewed to gain a full picture of the evolution and potential trajectory of the value chains. In due course, priorities can be assigned to the different elements.
2. *The time available to assess all of the elements of competitive capability would limit the amount of data that could be collected and literature that could be reviewed.* For that reason, an understanding of the cost structure would necessarily be based on best estimates rather than a statistically appropriate sample that might allow an evaluation of confidence level or interval.

The overview of the research proposal noted:

- This is about competition and developing competitive advantage: it concerns Thailand's ability to innovate with its active R&D program on rice varietal improvement that responds

³⁶ Higher yields are obtained by a number of other producers as varied as Australia, the United States, and Egypt, while many other suppliers have lower production costs.



to market demand, it is about the high level of integration and price responsiveness of Thai farmers to changes in the international markets, it is about Thai government support to the industry through tax incentives and it evokes the management of standards in the cluster and the active promotion and marketing of rice by the Thai Exporters' Association.

- So this is not simply a data gathering exercise. We need the numbers to pin point where the West African industries should focus attention, but we must go beyond to fully understand how to compete.

Data sources

Information was gathered from published and unpublished reports and articles, secondary sources, and personal contacts (Tables A1.21 and A1.22). That information provided an entry point for cost data as well as the breakdown of activities along the chain and the likely value. Close contact with rice agronomists and researchers in each country³⁷ gave secondary access to their evaluations of production costs. The study thus represents a pragmatic compromise in which interviews along the length of the value chain were complemented by input from other players with supporting roles along the chain and from published and unpublished sources (the extensive literature consulted for this work is reflected in the references).

Over 140 interviews were conducted, including a range of interviews with actors from various parts of the value chain to determine processes and practices, costs, strengths, and weaknesses. Rather more interviews were carried out in Thailand with farmers from the Northeast, the source of Thai jasmine rice, because there was substantially less published information on production and commercialization in the area. Others working in the rice sector were consulted as well: private

Table A1.20: Areas selected for the study

Country	Region	Rice	Notes
Thailand	Central Plains	White rice (Suphanburi); fragrant rice (Pathumthani)	Area producing the bulk of Thai rice. Irrigated, mechanized, high yielding, two crops per year.
	North East	Jasmine rice (Khao Hom Mali)	Area producing Thai jasmine rice an important component of rice imports to Ghana and Senegal. Rainfed, low yielding, partially mechanized, single crop per year.
Senegal	Senegal River Valley	White rice and aromatic rice (first year of trials, so output and other variables hypothetical)	Irrigated, partially mechanized, two crops per year. Output distributed around the country.
Ghana	Volta Region	Aromatic rice (Jasmine 85)	Rainfed, partially mechanized, single crop per year. Output marketed in Accra.
	Northern Region	White rice	Irrigated, potentially two crops per year. Output marketed beyond production area.

Source: Authors.

³⁷ Our contributor in Senegal, Amadou Abdoulaye Fall, is Director for ISRA in Saint Louis.



TableA1.21: Major sources of secondary information

Thailand	Senegal	Ghana
Office of Agricultural Economics; Rice Department; Chiang Mai University; FAO; Field Crops Research Institute; IRR; USDA	ISRA; SAED; AfricaRice; IPAR; Projet Croissance Economique; ARM; JICA; AFD	Ghana Rice Interprofessional Body; Statistics MoFA; CRI; Savanna Agricultural Research Institute; JICA; USAID ADVANCE; AFD

Source: Authors.

Note: AFD = Agence Française de Développement; ARM = Agence de Regulation des Marchés; CRI = Crops Research Institute; FAO = Food and Agriculture Organization; IPAR = Initiative Prospective Agricole et Rurale; IRR = International Rice Research Institute; ISRA = Institut sénégalais de recherches agricoles; JICA = Japan International Cooperation Agency; MoFA – Ministry of Food and Agriculture (Ghana); SAED = Société nationale d'aménagement et d'exploitation des terres du Delta du fleuve Sénégal et des Vallées du fleuve Sénégal et de la Falémé; USAID ADVANCE = United States Agency for International Development's Agricultural Development and Value Chain Enhancement program.

organizations (importers, traders, and so on); government organizations (research, extension, and national statistical agencies); and NGOs and donor partners. More detailed interviews were carried out with various players in the value chain, principally to verify data from secondary sources.

A particular aim was to base the data

around costs that were typical for 2010, which entailed some updating of information.

Given the emphasis on secondary information, descriptive statistics of the information cannot be provided. The costs reported here are best estimates and not intended to be further analyzed; rather, they give an indicative picture of one competitive element, namely costs. The incremental gain in carrying out further interviews to verify the range and variance of costs within each activity was judged to be small without a major extension of the survey. A statistically valid sample would require a different approach.

The sampling represented a series of case studies rather than an attempt at a statistically valid sample, but it became clear early in the study that the range of practices, problems, yields, and so on within any link in the value chain would preclude the construction of a valid sample even within a defined geographical range. The intention then was to contrast the practices in the value chains in the study areas. By using numerical estimates, the differences between best estimates of typical costs or practices could be highlighted, although the results are in no way definitive or sample-based costings.

Data from both primary and secondary sources were patchy and rarely complete. The data from all sources were combined to create spreadsheets modeling the value chains. In each country, two or three industry or institutional participants reviewed the cost breakdowns. Where necessary, adjustments were made to reflect their comments, but for the most part it seemed that the models were acceptable.

Models for Thai rice were adjusted to reflect the grade of rice being exported. This step was the key to understanding the comparative value of Thai rice in West Africa and of domestically produced rice. For example, broken rice in Thailand is a byproduct of the milling industry and has a

Table A1.22: Detailed interviews with primary sources

Country	Production	Processing	Distribution
Thailand	14	3	8
Senegal	3	2	6
Ghana	4	4	6

Source: Authors.



significantly lower value than that of whole grains. Broken rice trades at a lesser discount today than in the past, when demand for it was lower. In recent years, a number of markets for broken rice, notably for animal feed and noodles, have developed, and the demand for the broken grades is more active.

Once verified, the data were used to construct waterfall charts of the buildup in value of rice from producers in Senegal and Ghana to their home markets and from Thai producers to markets in Dakar and Accra.

Further work

The results of the survey are indicative values. Although they have been checked with industry observers, substantial uncertainty remains. Comments and criticism are invited to refine the data.

This study establishes a framework that can be used for regular review or more detailed investigation. The format allows costs and values to be compared between countries, and further countries can be added. A clear next step would be to use the data here as a guide to a rather more detailed survey of specific areas.

It can be seen from the results tables and charts that the greatest area of concern is at the top end of the value chain. Distribution costs are relatively straightforward to establish, and the margins in the lower reaches of the chain are restrained by the competitive operating environment. The milling in Africa is a service, and in Senegal the charges are fixed, with the only variation being in the retention or return of the bran. In Thailand, the mills for the most part take ownership of the paddy, and milling costs are harder to establish, although the value of white rice ex mill is relatively easy to establish from the trade. At the production level, however, the variation in total costs, and also in productivity, is great in all three origins.

At this level, one needs to divide attention between the fixed and variable costs. Fixed costs are often omitted from the production costs, because they are generally concerned with gross margins, but the fixed costs merit a clearer understanding. The approach here was to use the costs that were judged to be paid, but the real costs are then obscured.

Further investigation is recommended in:

- *Irrigation.* The full cost of irrigation is not factored in to Thailand, where the government carries the cost and the farmer is protected, and in Ghana, where too often the operating and maintenance costs are ignored. The full capital costs need closer consideration with a depreciation over a 30-year life. Good data are available for the public developments on the Senegal River.
- *Land.* Thailand, where titling has been extensive, has a functioning market for land, so an opportunity cost can be included. In Senegal and Ghana, markets are less transparent, and a closer inspection will be needed.

With the variable costs, alternatives within each activity can confound a comparison of like with like and will require a stratification of the sampling. ISRA has started an extensive survey of farmers, traders, and millers to better establish the costs with an appropriate level of confidence. The outcome of that survey, which will take some months to complete, will be of interest here and could be usefully replicated in a number of producing countries as a benchmarking exercise.



The key aspect of labor use is more easily discovered. Although we may not learn about the value chain from this element, the need for labor determines the extent of land that a single family can farm and therefore the relevance of profitability. Income, rather than profitability, is the critical measure here, and a comparison of farm income between countries should be revealing. The drive for self-sufficiency cannot be based on impoverished farming families relying on meager sales of surplus to subsist.

Finally, it must be recognized that the underlying data on area and production, and therefore productivity, are too often uncertain, particularly in Africa. The current estimates for production in Senegal were undoubtedly influenced in 2009 and 2010 by the political expediency of reporting the success of the presidential initiative, while in Ghana trade sources suggest that the amount of rice entering commercial channels differs radically from the published production data. A survey is overdue to support future planning.

Results

Economic environment

According to economic indicators, Thailand has a more developed economy, with substantially higher GDP per capita, longer life expectancy, and a higher ranking in the United Nations Development Programme's Human Development Index (Table A1.23).

Other key points include:

- Thailand is an easier place to do business and has a higher ranking on most business metrics.
- The food supply is more diverse in Ghana and Senegal than in Thailand. A transformational change across all products is more difficult to achieve in Africa than it was in South-east Asia, where the Green Revolution could focus on rice alone.
- Rice consumption rates in Senegal are approaching those in Thailand; other authors give higher consumption rates for Senegal based on market interviews. Data here are calculated from the food balance and population data.
- In Ghana, starchy roots are a major component of the diet.
- Meat consumption rates are far higher in Thailand than in the African countries studies here, as expected because of higher incomes.

Costs of production

According to data received from AfricaRice, the per hectare costs of producing rice in the Senegal River Valley vary widely (Table A1.24). The range of yields is not known, but it can be assumed that the highest-cost producers use the recommended level of inputs, possibly supplement with irrigation if necessary, and achieve yields of 5.5 tons per hectare and above. The range and variance are such that the sample size for valid comparisons of costs will be great.

On a yield basis, it seems that production costs in Senegal are comparable with those in Thailand for the varieties that might be exported to Africa (Figure A1.26). Rice cultivation in the Senegal River Valley is partly mechanized, and yields in the range of 5–6 tons per hectare are comparable



Table A1.23: Economic and agricultural indicators for Thailand, Senegal, and Ghana

	Year	Unit	Senegal	Ghana	Thailand	Source
Economy	Population	2010 Mn	12.43	24.39	69.12	http://databank.worldbank.org
	GDP	2010 USD Mn	12,954	31,306	318,847	
	GDP per head	2010 USD/head	1,042	1,283	4,613	
	GDP Growth	2010 %	4	7	8	http://data.un.org
	Life Expectancy	2009 Years	59	63	74	
	Human Development Index	2010 Rank (out of 183)	144	130	92	
Agriculture	Agriculture value added as a share of national GDP	2010 %	17	30	12	http://databank.worldbank.org
	Arable Land (in production)	2008 ha/head	0.3	0.2	0.2	
	Rural Population/ Total	2010 %	57	49	66	
	Fertilizer consumption	2008 kg/ha	2.4	6.4	130.9	
	Ease of Doing Business	2012 Rank (out of 183)	154	63	17	www.doingbusiness.org
Business Metrics	Starting a business	2012 Rank (out of 183)	93	104	78	
	Getting credit	2012 Rank (out of 183)	126	48	67	
	Protecting investors	2012 Rank (out of 183)	166	46	13	
	Paying taxes	2012 Rank (out of 183)	174	90	100	
	Trading across borders	2012 Rank (out of 183)	65	90	17	
	Enforcing contracts	2012 Rank (out of 183)	145	45	24	

(continued on next page)



Table A1.23: Economic and agricultural indicators for Thailand, Senegal, ... (continued)

	Year	Unit	Senegal	Ghana	Thailand	Source
Cereals	2007	kg/head/ year	163.90	98.37	126.24	www.faostat.fao.org
<i>of which rice (milled eq)</i>	2007	kg/head/ year	73.79	28.19	103.09	
<i>maize</i>	2007	kg/head/ year	25.62	35.81	8.09	
<i>millet</i>	2007	kg/head/ year	24.39	5.18	0	
<i>sorghum</i>	2007	kg/head/ year	6.53	10.19	0	
<i>wheat</i>	2007	kg/head/ year	33.49	18.8	15.05	
Fruits	2007	kg/head/ year	17.22	146.22	90.91	
Pulses	2007	kg/head/ year	4.51	0.73	2.28	
Starchy roots	2007	kg/head/ year	26.55	377.79	18.18	
Sugar & sweeteners	2007	kg/head/ year	15.70	12.01	37.62	
Vegetable oils	2007	kg/head/ year	14.06	9.79	6.9	
Vegetables	2007	kg/head/ year	58.23	35.71	40.14	
Meat	2007	kg/head/ year	13.54	13.51	28.31	
Seafood	2007	kg/head/ year	29.56	24.26	30.87	

Source: Compiled by authors from sources listed in table.

Table A1.24: Rice production costs per hectare in two regions of the Senegal River Valley (wet season)

	Delta Sample size = 150		Moyenne Vallé Sample size = 315	
	CFA/ha	US\$/ha	CFA/ha	US\$/ha
Maximum	532,284	1,183	583,950	1,298
Minimum	163,500	363	136,250	303
Median	349,480	777	335,996	747

Source: AfricaRice, personal communication.



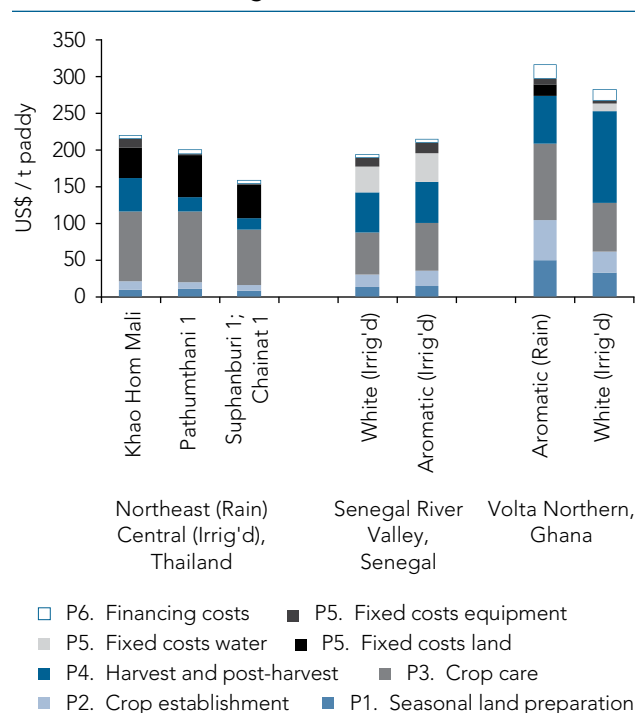
to Thai output. Ghana, however, has substantially higher production costs that reflect the raised costs of cultivation and the lower yields. Note that the figures for aromatic rice in Senegal are experimental.

The higher costs in Ghana largely relate to the lack of mechanization in rice production from land preparation to harvest (Figure A1.27). Although the fixed costs, in terms of equipment purchase and operation, are lower, they do not compensate for the lower productivity of labor-based cultivation. For example, seasonal land preparation and crop establishment costs amount to about US\$ 62 per ton of paddy in Ghana, whereas in Thailand they are estimated to be US\$ 26 per ton.

Note the variation in labor costs (Table A1.25). The need for mechanization in Thailand has been driven by the migration of rural labor to urban factories under the economic boom over the last 20 years.

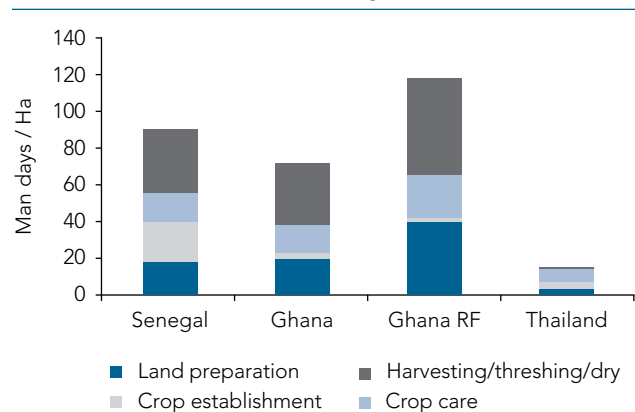
Fixed costs of irrigation vary substantially. As mentioned, Thailand provides water for free, which can be considered a subsidy. In Ghana, farmers are charged for the cost of supplying irrigation water, but often the fees may not be paid. In Senegal, a cost structure is calculated and applied by the irrigation authority. The fee system includes an element of capital recovery, and depending on the type of management (PIP, PIV, or GA)³⁸ may add around CFA 96,000 per hectare (US\$ 213 per hectare) to the cost of production.

Figure A1.26: Estimated breakdown of rice production costs in Thailand, Senegal, and Ghana



Source: Based on team data and interviews.

Figure A1.27: Labor use in rice production in Thailand, Senegal, and Ghana



Source: Based on team data and interviews.

Note: I = irrigated; RF = rainfed

³⁸ PIP = Périmètre Irrigué Privé, Senegal, PIV = Périmètre Irrigué Villageois, Senegal, and GA = ?

For chemical input use, without a full survey it is difficult to determine how much is applied in reality. Based on the levels recommended by local support services, the additional cost per hectare varies from US\$ 130 to US\$ 270, depending on the application rate, compound applied, and any subsidy that is in place (Table A1.26).

Table A1.25: Minimum wage levels, Thailand, Senegal, and Ghana (2011)

	Thailand	Senegal	Ghana
Minimum wage	US\$ 5.30–7.39	US\$ 3.30	US\$ 2.45

Source: Official statistics.

Table A1.26: Fertilizer use in rice production in Thailand, Senegal, and Ghana

Inorganic Fertilizer application – macro nutrients								
	Country	Thailand			Senegal		Ghana	
	Province, Region	North East	Central		Senegal River valley		Volta	Northern
	Rice type/variety	Khao Hom Mali	Pathumthani-1	Suphanburi-1; Chainat-1	White	Aromatic	Aromatic	White
Application rate kg/ha	46-0-0	146	167	167	300	300	125	125
	16-16-8 (16-7-7)	146						
	15-15-15 (15-7-12)	146	63	63			250	250
	16-20-0 (16-9-0)		229	229				
	15-5-20		63	63				
	18-46-0							
Total Applied as Available Element kg/ha	Nitrogen	112	132	132	156	156	95	95
	Phosphorus	20	25	25	20	20	16	16
	Potassium	27	18	18	0	0	31	31
Fertilizer Prices – USD per kg		1 USD = 30 THB			450 XOF		1.5 GHS	
	Country	Thailand			Senegal		Ghana	
	Province, Region	North East	Central		Senegal River valley		Volta	Northern
	Rice type/variety	Khao Hom Mali	Pathumthani-1	Suphanburi-1; Chainat-1	White	Aromatic	Aromatic	White
USD/kg	46-0-0	0.60	0.50	0.50	0.32	0.32	0.47	0.35
	16-16-8 (16-7-7)	0.60						
	15-15-15 (15-7-12)	0.60	0.57	0.57			0.60	0.36
	16-20-0 (16-9-0)		0.51	0.51				
	15-5-20		0.57	0.57				
	18-46-0				0.78	0.78		

(continued on next page)

Table A1.26: Fertilizer use in rice production in Thailand, Senegal, and Ghana (*continued*)

Inorganic Fertilizer Cost		USD/ha		450 XOF		1.5 GHS		
Country		Thailand		Senegal		Ghana		
Province, Region	North East	Central		Senegal River valley		Volta	Northern	
Rice type/variety	Khao Hom Mali	Pathumthani-1	Suphanburi-1; Chainat-1	White	Aromatic	Aromatic	White	
USD/ha	46-0-0	88	83	83	95	95	58	43
	16-16-8 (16-7-7)	88						
	15-15-15 (15-7-12)	88	36	35			150	90
	16-20-0 (16-9-0)		116	116				
	15-5-20		36	35				
	18-46-0				78	78		
	Total	263	271	270	173	173	208	133
Assumed yields t/ha paddy	2.81	4.50	5.60	5.50	4.90	4.00	3.00	
USD/tonne paddy	94	60	48	31	35	52	44	
Assumed yields t/ha milled	1.74	2.76	3.49	3.58	3.19	3.40	1.80	
USD/tonne milled	151	98	77	48	54	61	74	

Source: Authors' interviews.

Milling

While an estimated 40,000 artisanal mills operate in Thailand, rice is mostly processed for export by a subset of large, industrial-scale mills. The exporters, particularly for the Africa trade, will buy substantial quantities and will prefer to buy from mills capable of supplying volume and quality. In the Thai value chain, paddy is purchased by the mill and sold after processing, so quality and matching customer demand is a key concern of the miller.

In Senegal, most rice is processed by artisanal mills, but the rice sold in urban markets will mostly have been processed by the larger mills. As indicated, most mills operate as services for a fixed fee per bag of paddy processed, and they have no incentive to push for quality. The same occurs in Ghana, where only the largest mills have the resources to buy paddy.

Processing costs per ton of paddy are not substantially different in Ghana (US\$ 31.0) and Senegal (US\$ 31.75). The fee in Senegal is marginally higher, but the farmer may be able to sell the bran with an abundant livestock industry in the area and demand from Mauritania, too. In Thailand, the scale is dramatically different, but we estimate the cost of milling, after selling the bran, the husk, and critically also the broken grain, at about US\$ 25 per ton of paddy for whole grains, allowing the miller a margin of US\$ 7.27 per ton of paddy. Processing in Thailand also includes a high level of grading.

Linkages

Thailand has significant vertical and horizontal linkages in the rice value chain. As noted earlier, Thai exporters evolved out of family-owned mills, and many such connections remain in the business. The mills themselves are distributed throughout the producing areas, and quality signals are transmitted back to the farmer in paddy prices. Horizontal linkages were found at all levels in the chain, from an active exporters' association up to over 3,000 agricultural cooperatives. The impression is that much greater social capital is found in the Thai industry than is found in either Senegal or Ghana.

Senegal has seen substantial efforts to link farmers to producer organizations. Credit and improved seed are available only to farmers who belong. While incentives exist in Ghana for farmers to organize, farm-based organizations seem less prevalent. The marketing and distribution of rice in both Senegal and Ghana are fragmented to the point of being atomized. Milled rice is marketed for the most part without coordination by individual farmers once credit obligations and family needs are taken into account.

Transport

Freight haulage in West Africa is expensive. As an example, the journey from Saint Louis in the rice-growing Senegal River Valley to Dakar is about the same as the distance from the Hom Mali production area of northeastern Thailand to Bangkok (about 300 kilometers), but the cost of hauling rice over that distance is reportedly about US\$ 15 per ton in Thailand and more than US\$ 155 per ton in Senegal.

A number of studies have been done on transport inefficiencies and logistics in West Africa,³⁹ not least because in many respects there is a relatively well-connected road network. The condition of the rural roads is quite variable, but the main axes or corridors are relatively well served. Researchers report that while the price of freight is substantially higher than the actual cost of physical transport, the difference is accounted for by inefficient management of logistics and the bureaucracy involved. The West African Trade Hub, a USAID project based in Accra, has instigated a series of reviews of costs and delays along major trade corridors in West Africa and can now plot the on-road costs, formal payments, and informal bribes as well as the delays. One of the surprising findings⁴⁰ is that the delays and bribes ("although a serious and highly visible cancer on society") are a small part of the total delays and bribes. In fact, most obstacles to transport are quite legal and derive from a lack of professionalism and free competition in the transport sector as a whole.

³⁹ See, for example, Dorosh et al (2009); Teravaninthorn, and Raballand (2008); Zerelli and Cook (2010); Annequin and Eshun (2010); Annequin et al. (2011); and Bromley et al (2011).

⁴⁰ Annequin and Eshun (2010).



Finance

It seems, but has not been properly investigated, that producers in Thailand have less need for finance than producers in Ghana or Senegal but have better access to credit. The BAAC in Thailand has developed capability and experience in lending to farmers with or without physical collateral, and real interest rates are 3 percent or less at current levels of interest and inflation. For mills and exporters, the scale of operations requires the participation of commercial banks, but this sector is quite capable and sophisticated. Longer-term finance, mortgages, and leasing are all available.

In Senegal, farmers can obtain credit through their economic interest groups, but the reputation of the lender (CNCAS) suggests that credit can be cumbersome to obtain. With few assets and limited cash, most farmers depend on credit for growing rice. Their use of credit causes the immediate sale of one-third of the harvest to repay loans. The concentration of sales puts pressure on mills to process and exerts a downward force on prices at harvest. The mills do not have access to finance and are necessarily service providers. It seems that traders too rely on credit from farmers, which they repay once they have sold the produce in the market.

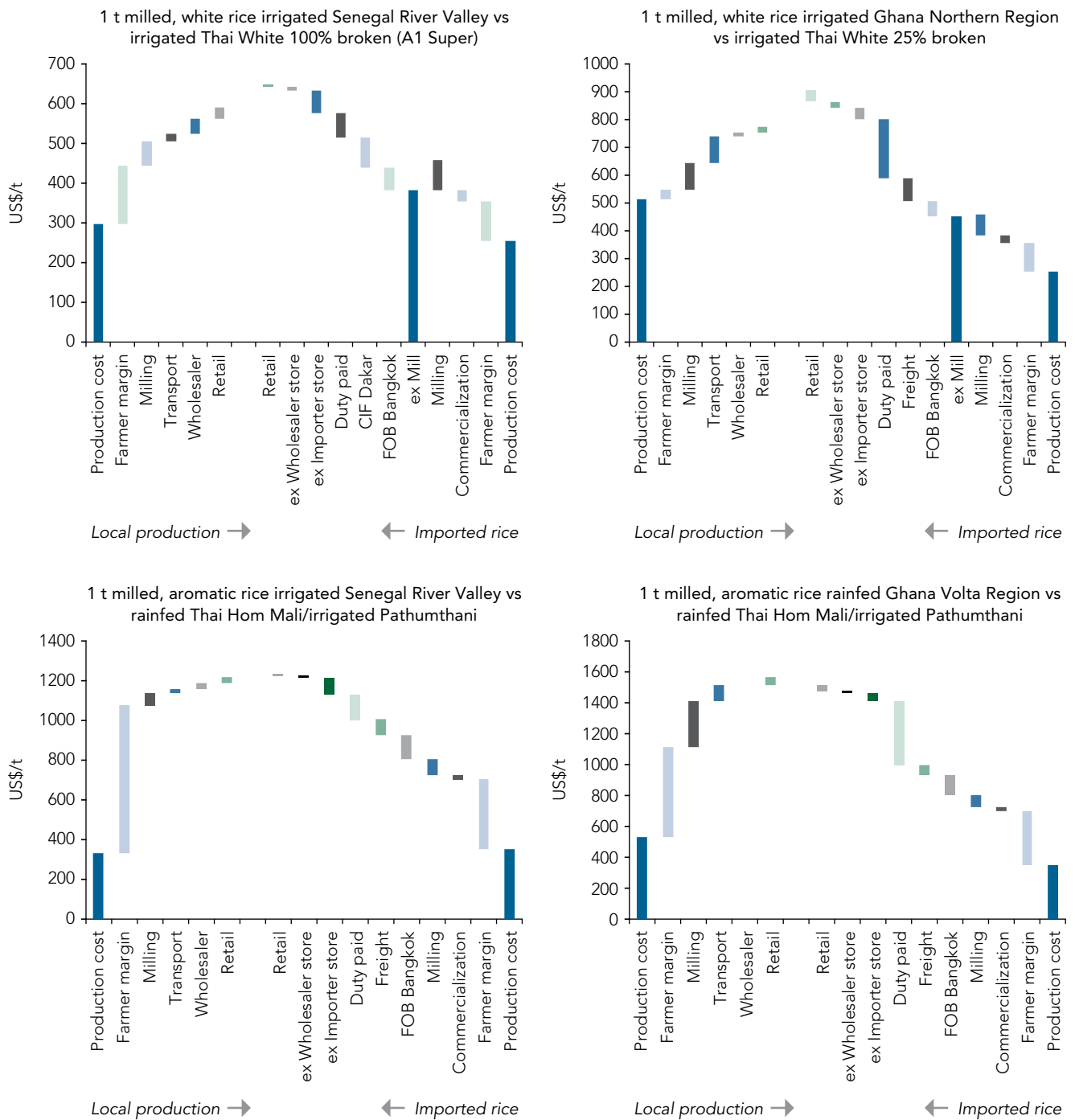
In Ghana, credit for farmers is limited to loans from the Agricultural Development Bank and the rural banks.

Overall

Figure A1.28 compares rice value chains leading to the consumer from local production in West Africa and imported rice from Thailand. Similar rice varieties are matched. For imported aromatic rice, blending between Hom Mali and Pathumthani keeps the costs lower and seems to account for current market prices. Nevertheless, imported rice is expensive in both Ghana and Senegal. Freight and import duties, which in Ghana combine with levies to add almost 40 percent to the value of the imported rice, significantly add to the cost for consumers, but as the figure demonstrates, they protect local producers. Aside from the potential margins available to producers of aromatic rice in Ghana and Senegal, there is no clear evidence of excessive margins along the value chain, in general.

In conclusion, if growers who are experimenting with aromatic rice in Senegal can produce to Dakar standards, the prize is clear. In Ghana, where Jasmine 85 and Togo Marshall aromatic rice have been grown for some years now, farming in some areas would seem to be highly profitable. At current world prices, import parity is achieved even by Ghanaian rice with its high production cost, as long as the duty on imports remains high.



Figure A1.28: Value build-up in the rice markets of Senegal and Ghana

Source: Authors.

Note: Thai A1 Super production cost is adjusted by a factor of 0.83 to account for broken grains, which are sold after milling as a byproduct.

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