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**Implications of Asia’s Changing Rice Economy for
the Development of Rice Value Chains in West Africa**

by

Ramziath T. Adjao and John M. Staatz***INTRODUCTION**

Rice is at the center of food policy debates in West Africa.¹ Driven by its convenience in preparation and consumption and higher consumer incomes, per capita consumption grew from just under 15 kg/year in 1970 to 40 kg/year in 2011 while population tripled during the same period. As a result, imports have soared, from 464,000 metric tons (m.t.) in 1970 to 6.4 million m.t. (44% of West Africa’s total rice supplies) in 2011. The 2007/08 spike in global food prices and the imposition of export bans by key Asian exporters laid bare the region’s vulnerability to outside supply disruptions and stimulated massive actions by individual countries and the region as a whole (through regional organizations such as ECOWAS and WAEMU) to expand rice production, aimed at reducing import dependence and creating new markets for West African farmers.

These production initiatives have expanded rice production in the ECOWAS zone from 6.9 million m.t. in 2008 to 11 million m.t. in 2013,

but have relied heavily on input subsidies as well as investment in new irrigation infrastructure. Over the long term, such production will only be economically sustainable if it can deliver local rice to West African consumers in the qualities desired and at a price that is competitive with imports. The bulk of those imports come from Asia, although imports from the Mercosur countries (Argentina, Brazil, Paraguay and Uruguay) have also increased sharply since 2008 (Mendez del Villar and Bauer, 2011).

This policy brief discusses key issues that will influence the future competitiveness of West African rice value chains vis à vis imports. Topics addressed include: (a) structural characteristics of the global rice economy that influence world trade and prices; (b) recent trends in the Asian rice economy that will influence future trade patterns; (c) estimates of the current competitiveness of irrigated rice systems in three major West African producers (Côte d’Ivoire, Senegal and Mali); (d) major factors that will influence the competitiveness

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¹ In this brief, “West Africa” refers to the 15 member countries of the Economic Community of West African States (ECOWAS): Benin, Burkina Faso, Cape Verde, Côte d’Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Unless otherwise noted, all production, trade and consumption figures cited in this brief are from FAOSTAT, 2015.

of these systems in the future, and (e) the implications of these findings for efforts to expand West African production, such as the ECOWAS-supported Regional Offensive for Sustainable and Sustained Recovery of Rice Growing in West Africa.

KEY CHARACTERISTICS OF THE WORLD RICE ECONOMY

About 90% of the world's rice is grown and consumed in Asia. China and India are the largest Asian producers, accounting collectively for nearly half of world production and consumption in 2014. Most Asian countries consume more than 100 kg of rice per capita per year on average, with the figure exceeding 200 kg per year in Cambodia, Laos, Bangladesh and Vietnam. However rising incomes, urbanization and changing lifestyles are leading to diet diversification in many Asian countries. As a consequence, rice consumption per capita is falling in some of the most rapidly growing countries. In China, for example, total per capita cereal consumption decreased from about 400 kilocalories (kcal) per day to about 150 kcal per day over the period 1961-2009 and is now exceeded in terms of kcal contribution by meats and by vegetables (Chen et al, 2013). In contrast, per capita rice consumption in West Africa (at approximately 40 kg/year) is lower than in Asia, but is growing rapidly.

Only 7% of world rice production enters into international trade, the rest being consumed in the country where it is produced. In the late 2000s, the top five exporters (Thailand, Vietnam, India, the USA, and Pakistan) accounted for 80% of total exports, with just under half of total exports being sent to countries in Asia. Hence, the market for rice is thin, with relatively small changes in production, import demand in Asia or export policies in the major exporting countries having a large impact on prices. Moreover, rice is not a homogeneous commodity. Wide variation exists among varieties and types of processing (e.g., parboiled vs. polished; broken vs. whole grain), corresponding to consumer preferences that differ across countries and income classes. Consequently, the market for rice also highly segmented, with substantial price variations

over time and across different types of rice. These structural characteristics of the international rice market were exemplified in the 2008, when shortfalls in production coupled with export restrictions by major Asian exporters (aimed at protecting domestic consumers) resulted in the FOB price of the benchmark Thai 5% broken milled rice nearly tripling between April 2007 and April 2008 (from US \$316/mt to \$907/mt) (World Bank, 2016).

RECENT TRENDS IN THE ASIAN RICE ECONOMY

Key changes in the Asian rice economy over the past 20 years have included the following (Reardon et al., 2014; Adjao, 2016): (1) rice's share in the diet of most Asian consumers has been declining; (2) value chains have lengthened geographically by sourcing paddy outside their traditional production zones, but shortened intermedationally, with a reduced role of village traders or brokers; (3) increased concentration of farms as well as consolidation in the mill and wholesale segment have reduced transaction costs, created scale economies and increased efficiency; (4) rapid development of markets for seed, water, land, fertilizers, machine services, and pesticides/herbicides have accompanied rapid commercialization, driven mainly by the private sector; (6) strong vertical coordination among businesses throughout the value chain was further strengthened by public and private investment in transport and communication infrastructure; (7) government provision of key investments in research and development of improved seeds, roads, power grids, and liberalization of foreign direct investment in retailing and processing facilitated the emergence and growth of these markets, except in India, where in some instances government interventions crowded out the private sector.

Challenges, however, lie ahead. Although the Green Revolution (GR) led to rapid growth in cereal yields, productivity in the "rice granary" areas across Asia has leveled off. Despite continuing improvements in crop varieties (e.g., the recent release of hybrid rice), annual production growth rates are slowing, with the

compound rate of 2.5% per year over 1962-1979 falling to 1.4% per year over the period 1980-2011 for Asia as a whole. Evidence from India's major irrigated-rice growing states and East Asia's rice bowls indicates that Total Factor Productivity (TFP) has been declining, meaning that farmers now have to use higher levels of inputs to obtain the same yields as before (Hazell 2008).

Moreover, the GR introduced new environmental concerns, especially related to the overuse and poor management of irrigation water, fertilizers, and pesticides, leading to soil degradation and build-up of toxins. Questions have been raised about the sustainability of intensively farmed systems, which lead to off-site externalities, including water pollution, silting of rivers and waterways and loss of biodiversity. Many Asian countries have taken steps in resolving these issues (i.e., adoption of improved soil nutrient, water, and integrated pest management) at high social costs, and much more efforts remains (Hazell 2008; Pandey et al. 2010).

Rapid urbanization, industrialization and development of infrastructure in many Asian countries have further limited the scope for bringing new good agricultural land into cereal production. New sources of irrigation water are also limited, while nonagricultural uses of water for urban, industrial, and environmental purposes are growing rapidly. Increasing rice production is constrained not only by worsening land and water scarcities but also (at least until recently) rising energy and fertilizer prices. Continued strong growth in the production of high-value foods is also adding to the competition with cereals for land and water. Climate change will exacerbate the problem by adversely affecting yields and increasing evapotranspiration.

Given this context, future increases in rice production in most Asian countries will have to come almost entirely from higher yields, with limited if any increase in the total amount of irrigation water used. If world energy prices rise in the future, it will also mean higher fertilizer and mechanization costs for farmers, placing a greater premium on the types of

management practices that aim to achieve environmental sustainability while increasing yields through more efficient use of these inputs. For instance, water-pricing methods will need to send stronger signals about the real value of water. Additional agricultural research will be the key to meeting these goals.

One likely source of increased Asian rice production is Myanmar, which already exported nearly 370,000 m.t. of rice to West Africa in 2012. The country may emerge as a major new low-cost exporter if its economy continues to liberalize and investments are made in improved port facilities (Wong and Wai, 2013). Such expansion could put downward pressure on world prices, particularly for the lower-quality rice that currently dominates the country's exports to West Africa.

CURRENT COMPETITIVENESS OF IRRIGATED RICE SYSTEMS IN WEST AFRICA

In order to assess the current competitiveness of West African irrigated rice systems compared with those of major Asian rice exporters, we analyzed a wide range of production and marketing data for rice produced in full water-control irrigation systems in Mali, Côte d'Ivoire and Senegal. Mali is the second-largest rice producer in West Africa (after Nigeria), and Côte d'Ivoire and Senegal are the region's second and third-largest rice importers (after Nigeria). Lack of comparable farm-level budget data precluded including Nigeria in the analysis. The analysis focused on full water-control irrigation systems because these systems account for the bulk of the marketed surplus of rice in West Africa and they are the systems that have received most public investment to date.

The analysis was conducted in terms of market and production conditions existing in 2011. It compared the competitiveness of rice produced from these systems with imports of Asian rice from two different perspectives. The first perspective is financial analysis, which calculates the cost of production and net value added using prevailing market prices, including

any taxes paid and subsidies received by value-chain actors. The financial analysis thus measures the profitability to private actors of rice production and marketing under existing market conditions. The second perspective is economic analysis, which nets out the value of any taxes and subsidies, including the effects of over- or under-valued exchange rates. The economic analysis thus measures the profitability to the economy as a whole of the activity, i.e., whether the country has a comparative advantage in rice production and marketing.²

The indicator used here to assess economic profitability is the Domestic Resource Cost (DRC) ratio. In this study, the ratio compares, in the numerator, the value (expressed in terms of foreign exchange) of domestic (nontradeable) resources (land, labor, capital) used in the production and delivery of a given amount of rice to the country's capital city with, in the denominator, the net value of foreign exchange that would be needed to replace the same amount of rice with imports. If this ratio is less than one, it indicates that it is cheaper to produce and deliver the rice domestically than to import it, and hence the country has a comparative advantage in providing the good. If the ratio is above one, the opposite is true (Adjao, 2016). The lower the value of the DRC ratio (the closer it is to zero), the higher is the comparative advantage of the country in rice production.

Financial analysis. Figure 1 compares financial costs of production, at the farm level, of paddy rice in Côte d'Ivoire, Mali, Senegal, India, Vietnam and Thailand. Senegal's cost, at slightly over US \$150/metric ton, is comparable to that of India and Thailand, but above that of Vietnam. The financial costs for Côte d'Ivoire and Mali exceed those India and Thailand by between 50 and 80%, and by an even higher amount for Vietnam.

Because consumer rice prices are higher in West Africa than in the Asian exporting countries, however, the financial profitability of the entire value chain, as measured by the cumulative net margin (value added) by all actors involved in producing and delivering rice to each country's respective capital city, is positive in West Africa and even higher than that of the three Asian countries (Table 1). The high financial profitability in the three West African countries is consistent with the rapid expansion of rice production in these countries since the rice crisis of 2008.

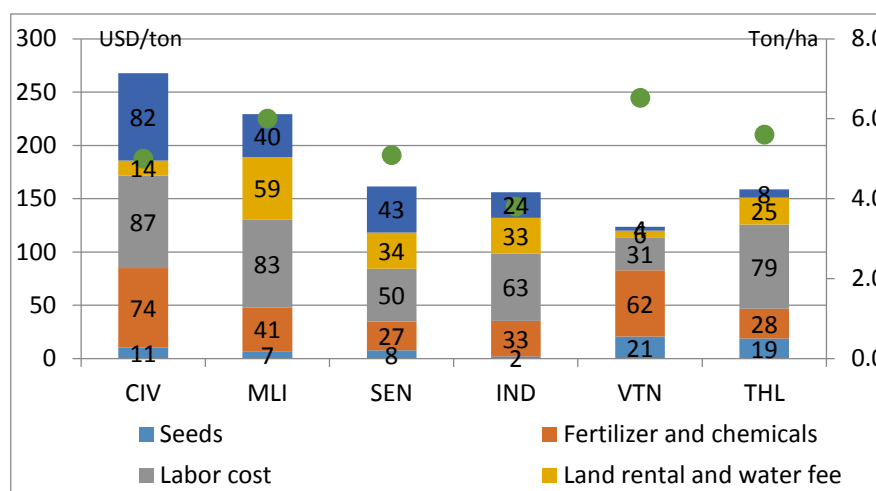
Economic analysis. When competitiveness measured using economic analysis, a slightly different picture emerges. The DRC ratios for Mali (0.68) and Senegal (0.78) are both below 1.0, indicating that under conditions prevailing in 2011 these countries had a comparative advantage in rice production. In Côte d'Ivoire, however, the DRC was 1.0, indicating that, from an economic standpoint, irrigated rice production in that country was just at a break-even point, and hence was highly vulnerable to shocks that could make it unprofitable from the perspective of the country as a whole. The divergence between Côte d'Ivoire's break-even position in economic terms and the financial profitability shown in Table 1 implies that the financial profitability in Côte d'Ivoire was driven by explicit and implicit subsidies to the rice sector.

It is not surprising that Mali has the strongest the comparative advantage in producing and marketing rice to its capital city, as Mali's landlocked position offers the country some natural protection from imports. In contrast, the major rice-consuming cities of Senegal and Côte d'Ivoire are close to ports, making access to imports cheaper.

² Economic analysis takes the prevailing world prices as given and does not take into account any taxes paid or subsidies received by actors in the exporting country. The justification is that the

importing country cannot affect these taxes and subsidies, and therefore the world price represents the opportunity cost to the importing country of producing the good rather than importing it.

Figure 1. Level and distribution of production costs for irrigated rice in Côte d’Ivoire, Mali and Senegal benchmarked to India, Vietnam and Thailand (\$ US/ton paddy)



Note: Other costs include machine rental, equipment maintenance and depreciation, interest on capital, gas and fuel, sacks; depreciation of irrigated infrastructure is excluded. **Source:** Adjao, 2016.

Table 1. Net Financial Value Added in Irrigated Rice Value Chains, 2011 (\$ US per metric ton of milled rice)

Country	Net Value Added
Côte d’Ivoire	263
Mali	250
Senegal	258
India	201
Vietnam	189
Thailand	148

Source: Adjao, 2016.

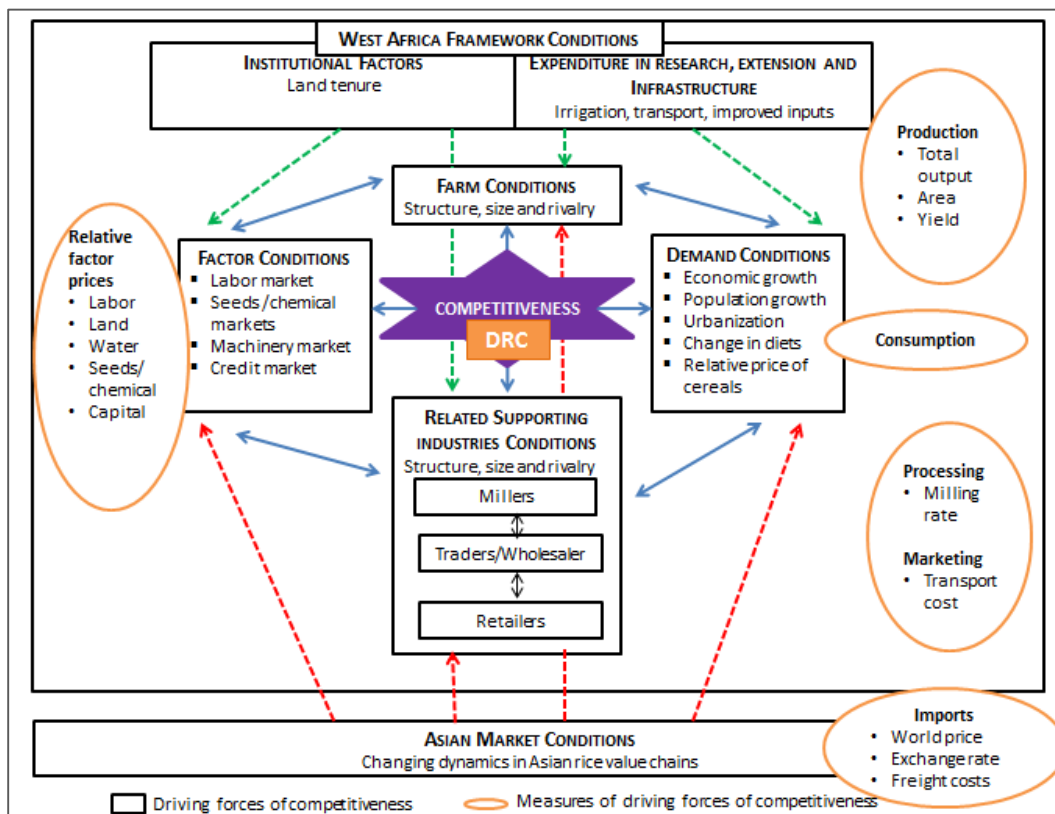
Our DRC results differ from those of a 2013 study by AfricaRice (Diagne et al. 2013), which found that Côte d’Ivoire had a comparative advantage in rice production (DRC = 0.57). That study, however, assumed that the major irrigation infrastructure was already paid for and thus did not have to be included in the analysis. The AfricaRice approach is only appropriate if one is analyzing the economics of expanding production within an existing irrigation facility that requires no new major infrastructure. Since

most rice production initiatives in West Africa involve bringing new areas under irrigation, it is preferable to include the investment costs of the new infrastructure in the analysis. The fact that excluding such costs makes a marginally unprofitable activity look highly profitable probably explains why many private promoters of expanded large-scale irrigation in Côte d’Ivoire (and elsewhere) have sought to have the infrastructure costs covered by government under the guise of a public-private partnership.

KEY FACTORS INFLUENCING FUTURE COMPETITIVENESS

Figure 2 illustrates the driving forces affecting future competitiveness of West African rice systems vis à vis their Asian counterparts. These range from institutional issues, such as land-tenure conditions, to exchange rates, access to new technologies, conditions in factor markets, and costs of both ocean and inland freight. We carried out sensitivity analysis of our DRC calculations with respect to several of these driving forces (shown as the circled items in Figure 2), including the world rice price, the

Figure 2. The Determinants of West African Rice Competitiveness



Source: Adjao, 2016

CFAF/US \$ exchange rate, ocean and inland transport costs, rice yields, costs of chemical inputs, the milling rates, irrigation costs, capital costs, land costs and the cost of labor. Key results were the following (for details, see Adjao, 2016):

- Competitiveness was most sensitive to projected declines in the world prices (a function of production costs in Asia) and a depreciation of the US dollar relative to the Euro (and hence the CFAF).³ For example, a 12% decline in world prices from 2011 levels would increase the DRC to 1.49 in Côte d’Ivoire and 1.07 in Senegal (making rice production economically unprofitable) and reduce Mali’s competitiveness (DRC increasing to 0.87). In reality, world prices in

dollar terms for Thai 25% broken rice fell by 27% between 2011 and 2015 (FAO, 2016), but this was largely offset by a 20% appreciation of the US \$ relative to the CFAF, resulting in a net decline in world prices, in CFAF terms, of 7%. The net effects of these actual price and exchange rate changes were to increase Senegal’s DRC to 0.94 (still marginally profitable in economic terms) but to turn Côte d’Ivoire’s production unprofitable (DRC = 1.27). Mali’s competitiveness declined but remained economically profitable (DRC = 0.79). Both the world price and the exchange rate are entirely outside the control of these three West African countries, so in order to strengthen their competitiveness, they need

³ The CFA franc (CFAF) has a fixed parity with the Euro (1 Euro = 656 CFAF). All three West African

countries analyzed here share the CFAF as a common currency.

to concentrate on factors that are within their control, such as investment costs in irrigation infrastructure and operational efficiency throughout the value chain.

- Increases in milling rates (rates of conversion of paddy into milled rice) and paddy yields were strong factors in increasing competitiveness, with increases in milling rates having a somewhat stronger impact than growth in farm-level yields. For example, a 5% increase in milling rates would decrease the DRC in Senegal from 0.78 to 0.73, while a 5% yield increase would reduce the figure to 0.75.
- The impact of changes in energy prices is ambiguous on the competitiveness of West African rice production. On the one hand, higher energy costs would raise the cost of ocean transport, thereby raising the cost of imports and improving West African competitiveness. On the other hand, costs of inland transport and energy-intensive inputs like fertilizer would also rise, hurting local competitiveness
- Higher agricultural labor costs in West Africa reduce competitiveness, with the effect strongest in Côte d'Ivoire, where a 20% increase in labor costs per m.t. of output would raise the DRC from 1.0 to 1.07, making rice production uncompetitive with imports.
- The cost of developing irrigation infrastructure is a major determinant of competitiveness. If these costs per ha could be reduced by 20%, production in Côte d'Ivoire would become competitive (DRC = 0.91) and that in Senegal and Mali would be even more so (DRCs falling from 0.78 to 0.72 in Senegal and from 0.68 to 0.63 in Mali).
- Malian rice production for the domestic market would remain competitive under a wide range of scenarios. In contrast, the competitiveness of Ivoirian production is very sensitive to the factors shown in Figure 2. Senegal occupies an intermediate position, often remaining competitive, but with some combinations of factors, such as declines in

the world price coupled with rising transport costs, eroding the sector's competitiveness.

POLICY IMPLICATIONS

Recent changes in the Asian rice economy suggest a favorable environment for expansion of West African rice production, as area is shifting out of rice in Asia, productivity growth is slowing and labor costs are increasing. In West Africa, large-scale irrigated production was financially profitable in 2011 in Senegal, Mali and Côte d'Ivoire, but only economically profitable the former two. This suggests that net subsidies to the rice sector since the 2008 world food price crisis have been an important contributor to expansion of production, at least in Côte d'Ivoire. The fact that production is economically profitable in Senegal and Mali suggests that current levels of subsidies are not needed for the sector to be competitive. Given its relatively high comparative advantage in producing and marketing rice to its capital city, Mali may even be in a position itself as a substantial exporter of rice to regional markets.

However, the competitiveness of West African rice value chains will depend on factors both outside the countries' control (such as world prices and exchange rates) and those they can influence (such as efficiency in production, processing and transport). World rice prices in dollars have declined since 2011, potentially weakening the competitiveness of West Africa's rice sector vis à vis Asian imports. Within the CFAF zone, however, this effect has been largely offset by a weakening of the Euro, and hence the CFAF, relative to the dollar. Should economic conditions in the European Union strengthen, the Euro (and hence the CFAF) could strengthen relative to the dollar, putting West African rice systems under greater competitive pressure. Therefore, focusing on improving the efficiency of these systems is critical. Increases in farm-level yields and milling rates, reductions in per ha investments in irrigation infrastructure, and reduced financing costs are among the most powerful factors that could offset the negative

impacts of unfavorable changes in world prices and exchange rates. The ability to achieve these increases in system-wide efficiency requires adequate investment in agrifood system research and extension. This raises the question of whether shifting public resources to such efforts from the current heavy expenditures on input subsidies might have a larger and more sustainable impact on West Africa's rice competitiveness than current policies. Another action that could improve competitiveness is the reduction of inland transport costs through efforts to increase competition in the trucking industry and reduce non-tariff barriers such as roadblocks, which increase the already high marketing costs of local rice.

Quality improvement can also strengthen the competitiveness of West African rice. In most countries of the region, consumers perceive local rice to be of lower quality than imports, frequently with higher levels of impurities such as stones and chaff. Demand for higher quality food products is increasing throughout West Africa, particularly among the growing middle class (Hollinger and Staatz, 2015). Therefore, increasing marketable volume of milled rice without addressing the quality issue may no longer be sufficient if West African rice value chains are to claim a bigger share of the booming West African rice market. Strengthening systems of contracting among farmers, their organizations, millers and marketers will be an important element in achieving such quality improvement.

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