Effects of Industrial Paddy Processing on Local Rice Competitiveness in Glazoué District, Benin Republic

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Authors' contributions

This work was carried out in collaboration between the two authors. They jointly designed the study and wrote the protocol. Author BAE carried out the field survey, performed the statistical analysis and wrote the first draft of the manuscript. Author BGH supervised the work, provided additional literature, fine-tuned the analyses of the study and oriented results' interpretation towards relevant policy implications and edited the manuscript. Both authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aims: This research aimed to assess the extent to which public investment in industrial paddy processing increases local rice competitiveness in Benin Republic, and to discuss policy implications of the findings.
Study Design: The study was conducted in the Glazoué district using the approach of comparing the outcome of a unique reference case (an industrial facility) with the average outcome of several cases of indigenous private mills.
Methodology: Based on interviews with the state factory manager, 25 rice processing-and-trade women and 30 consumers, competitiveness of three types of rice were compared: indigenous private mill-processed parboiled rice; state factory-processed rice, and imported rice. Competitive gains of the factory-processed rice over the indigenous one and vis-à-vis imported rice were assessed using quality index, market-gate cost price, and quality index/cost price ratio.

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Results: Imported rice is more competitive than local rice. Nonetheless, the factory-processed rice is more competitive than the indigenous one. The factory reduces market-gate cost price of local rice by 19.1% and brings down its overall competeveness gap vis-à-vis imported rice from 49.72% to 13.13%, i.e. a more than 4-fold increase in competitiveness.
Conclusion: Therefore, more public investment in such factories should be promoted, provided adequate market linkages are established.

1. INTRODUCTION

1.1 Background, Problem and Objectives of the Study

Accelerated agricultural development, food security and poverty reduction in Sub-Saharan Africa (SSA) cannot be achieved without genuine policy interventions to increase farmers' income and enable substantial gains in food value chains. One of the main causes of food insecurity is post-harvest losses that occur along the chains and lead to revenue losses and reduced real income for producers, while constraining consumers (especially the poor) to high food prices as a result low food supply [1]. Therefore, improving post-harvest methods, especially processing techniques, to raise the competitiveness and to increase market access of locally-produced food is a critical challenge which countries in Sub-Sahara Africa, including Benin Republic, must face [2]. Yet, progress achieved since independence days is little, regarding the impact of agricultural policies on livelihoods and food security of populations. An old debate is still evolving, as to whether governments should invest in large estates and industrial factories, or should they promote small-to-medium farms and enhance indigenous processing capacity through mechanical improvement with small equipment [3]. Various mixes of choices have been attempted, depending on the countries. In general, very limited success is observed so far, although interesting policy shifts are being observed in countries such as Ghana, Nigeria, and Ethiopia [4-7]. Today, existing rice production capacities in Africa are low and can meet only 10% of present demand and the continent therefore, accounts for 1/3 of global rice imports and spends about US $1.5 billion annually on rice imports [8,9].

The African rice sector paradox is pictured as follows: "It is ironic that in West Africa – the rice belt of SSA – although 20 million farmers are engaged in rice farming and about 100 million people depend on it directly for their livelihood, almost all the cities of the region are flooded with imported rice of various labels, everything except local rice… Why doesn't local rice find its way to the local markets? … Does the unavailability of local rice in the market mean that imported rice is cheaper and local rice cannot compete with it?" [9]. These two questions among many raised by these authors, are core to the issue of local rice competitiveness investigated in this paper, with a focus on paddy processing.

Local rice's consumption in Benin Republic represents only 10-15% of imports [10]. In order to reverse that trend, the government is striving to boost paddy production and to promote processing activities with the view to improving local rice competitiveness compared to imported rice. Domestic paddy production increased at the rate of 5.8% per year, from 16 498 metric tons (mt) in 1995 to 124 975 mt in 2010, as a result of average yield increase from 1.71 to 2.66 mt/ha [11]. Yet, that production is still below the needs. Between 2005 and 2007, about 60 000 mt were imported every year for domestic consumption [12].

Cost-effective paddy processing, rice quality and reliable market outlets are issues pending to be resolved in order to raise the competitiveness of locally-produced rice. That's why the rice sub-sector is one of the top priority food subsectors in Benin Republic's strategic plan for boosting the agricultural sector (PSRSA), with the aim of accelerating poverty reduction and economic development. In that stream, the government installed in 2012 two modern paddy husking factories, one in Malanville in the upper north and one in Glazoué in the center of the country. This action is intended to provide an incentive to paddy farmers to produce more and sell the surplus at pre-negotiated prices, while enhancing quality and affordability of local rice for consumers in the domestic market and the sub-region. Presently, paddy production in Glazoué is enough to supply the factory to its full running capacity. Yet, the following question comes up:

Does this policy intervention of public investment in industrial paddy processing increase local rice competitiveness in Benin Republic?

This study addresses the issue of market access and competitiveness of local rice produced in Benin Republic. It aims to assess the competitive gains of the modern paddy processing/husking factory installed in Glazoué compared to private mills that were already operating in the area before the government's action. For that purpose, the competitiveness gap of local rice vis-à-vis imported rice is assessed for each type of processing facility. The study investigates whether the factory enables a significant competitive gain over the indigenous system (women and existing private mills), with reference to imported rice[1].

Beyond a simple assessment of competitiveness gaps, one would be concerned with the development impacts of government support to industrial rice processing. The underlying development issue would be to know if the Government has made a right decision by investing in large-capacity modern paddy processing factories or should it go for a better option. In this respect, an immediate alternative option would be to promote the multiplication of private mills[2] through technical and financial assistance to rural paddy processing cooperatives and entrepreneurs to satisfy local demand for rice. This option aims primarily to enhance rural households' food security by making local rice more affordable, whereas the first one targets a substantial increase in farmers' income and export earnings for the government by targeting the regional demand for quality rice. Although both options would contribute to poverty reduction, their relevance for rural communities are not the same. However, the coexistence of both types of processing facilities may be justified if there is enough evidence that resources are economically used in either case.

In spite of their importance, development impacts of government intervention in rice processing will not be addressed in this paper, but it was worth drawing attention on them[3]. Here, considering that market is the driver of production and economic growth [13], the study rather analyzes the competitiveness of local rice, from the angle of sustained access to domestic market where competition by various sorts of imported rice has become very tough [14]. The paper focuses on competitive gaps at market level, based on empirical assessments of paddy processing costs and rice quality.

1.2 Literature Review

The theoretical background of the study includes the relationships between trade, industrialization, economic development and poverty reduction on the one hand, and the implications of competitiveness for agricultural trade in Africa on the other hand. These concepts and relationships are briefly reviewed in order to indicate how the study will contribute to enhancing their understanding through empirical application.

1.2.1 Trade, industrialization, economic development and poverty reduction

Most countries in Sub-Saharan Africa (including Benin Republic) are characterized by weak economies and a growing poverty, in spite of their natural resource endowment. That situation is due to low wealth creation capacities, including weak production, processing and trade capacities. In particular agricultural trade, which is due to be a source of wealth and autonomous growth for poverty alleviation [13], is still at its infancy and deals with raw or crude farm products. Openness to trade is key to economic development, as it improves people's living conditions [15,16]. Trade enables developing countries to get access to technologies that will help them to increase productivity, competitiveness and employment opportunities, especially for the poor [13]. It is believed that the

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[1]*It is assumed that imported rice is a reference, based on high consumers' preference for it. Although quality reference values for imported rice are not available at the beginning of the investigation, everybody knows that Beninese people have a very high preference for imported rice coming from various countries (Thailand, Vietnam, Malaysia, Pakistan, USA, etc.). However, the study empirically assessed consumers' preferences for various quality attributes for the three types of rice.*

[2]*This question has a larger dimension connected with the impact of industrial factories on local paddy production, on jobs initially created by women and private mills, on incomes of rice value chain actors and on rice consumption. The present study does not deal with that perspective.*

[3]*They encompass the effects of modern factory operations (paddy purchasing at guaranteed prices, application of quality grades and other contract specifications and market arrangements) on farmers' and private mill owners' incomes, and the overall rural transformation (labor dynamics, competition outlays) in local rice value chains. Therefore, analyzing the development issue of promoting modern factories vs. artisanal private mills, would involve more impact assessment variables (farmers' incomes, total added value and its distribution in the local rice value chain, community-level food security, inter-sector labor transfers, etc.) than product competitiveness indicators. The present study did not address it because this was not the initial orientation; moreover, enough resources were not available for such investigation.*

6% annual growth in the agricultural sector by 2015, recommended by the African Union (AU) to achieve the first Millennium Development Goal (MDG), will not be possible without accelerated industrialization, especially modern processing of locally-produced crude farm products, and trade mechanisms that promote quality standards to attract foreign exchange[4]. Trade will reduce wealth losses that occur through massive imports of basic goods that can be produced locally. As illustrated in Fig. 1, a dedicated support of the industrial sector is required in developing countries to improve trade and payment balances and boost economic growth [13]. Industrialization will contribute to reducing consumer prices of such goods and raise market accessibility for the poor [17] (Grain de Sel, 2012). In Benin Republic, the Agenda for Economic Emergence called Benin Republic Alafia 2025 put emphasis on the industrial push that is needed to boost agricultural productivities and farmers' incomes.

1.3 Competitiveness

Lachaal [18] provides a comprehensive economic literature review on competitiveness, covering concepts, definitions and application.
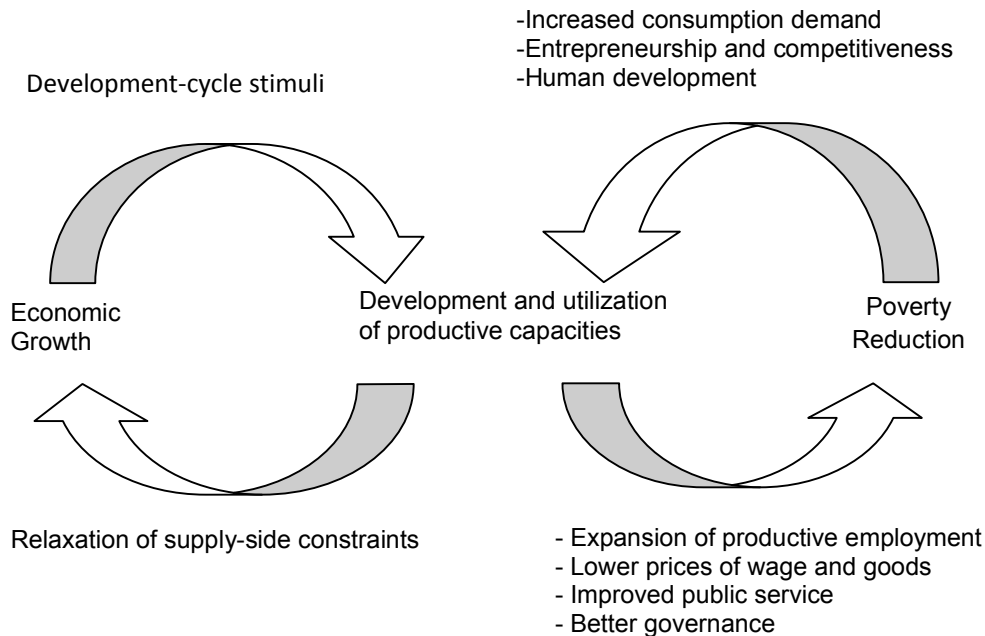
Competitiveness is the capacity to provide goods and services at the time and place and in the form desired by national and foreign buyers, and at prices equivalent to, or better than those of other providers, while recovering at least the opportunity costs of resources used [19]. An industry is competitive when it has the capacity to make profit and keep a certain share in the domestic and/or international market [20]. Therefore, farmers and domestic firms will need to raise their competitiveness to meet the demand of mass consumption goods such as rice. However, competitiveness (of a nation, a sector or a firm) is dynamic and closely related to its economic conditions as well as to international market conditions. An entity will remain competitive as long as it can continuously adjust in response to forces and factors that determine its position or competitive advantage in a liberalized market [18]. Most of previous assessments of competitiveness addressed static cases and they vary largely in their level of analysis (international, national, sector/sub-sector, and firm level). At the international level, the main determinants of competeveness include exchange rate, international market conditions, fares of international freight, and preferential arrangements between countries.

Fig. 1. Relationships between economic growth, productive capacities and poverty reduction
Source: Hayashikawa (2008), reporting UNCTAD

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[4]*See FAO Corporate Document Repository: Comprehensive Africa Agriculture Development Program, Chapter 1: Underpinning Investments in African Agriculture and trade-related Capacities for improved Market Access: A Continental Vision.*

At the national level, the determinants include resource endowments (human and natural resources), technology, product attributes or quality grades, economies of scale, trade policies and regulations [21,18]. At that level, balance deficits and factors' productivity growth are used to assess competitiveness [22,18].

At sector or industry level, production costs, factors' productivities, trade patterns are used for the same purpose, whereas market share and profit are the indicators frequently used at firm or micro-economic level [18].

A few previous studies assessed the competitiveness of locally-produced rice in Benin Republic. A one-season paddy production and low market supply [23], weak mechanization of paddy production and processing with negative impacts on rice quality [24], and non-attractive quality/price ratio are the main factors that limit the competitiveness of local rice. Adégbola and Singbo [10] found that local rice will not be competitive until paddy yields are increased, post-harvest operations are improved and marketing strategies are developed. Indeed, food prices consisted of 78% of post-harvest operations costs and only 12% of production costs [25]. For a same quality grade, local rice in Benin Republic is sold at prices 10-20% higher than those of imported rice [23]. However, although dumping of local markets with cheap, subsidized imports may be a reason for that situation, a non-biased comparison would have required that net trade margins be removed from those prices. In order to correct for such a bias, we compare market-gate cost prices of local rice and import parity prices of imported rice. The market-gate cost price of a locally-produced good includes its production and distribution costs at the specified market point/location. The import parity price of a good purchased in a foreign country is its unit value at a given location in the importing country if it would equally compete with the same good locally-produced [26].

Market-level or product competitiveness is determined by firm/industry-level or production-level competitiveness which entails cost reduction or optimal resource allocation. High production costs reduce market competitive advantage, whereas good product prices favour it. Finally over all streams of resource allocation in a value chain, profits drive firms' or industries' competitiveness. In that perspective, Diallo et al. [27] used the Policy Analysis Matrix (PAM) method [28] to assess local maize

competitiveness compared to imported maize in West Africa. Background papers for this study, e.g. [29,30] used the same approach. However, the latter, which addresses more firm's competitiveness than product's competitiveness, is not the focus of our study.

Most of previous competitiveness studies [10,14, 29] in Benin Republic focused on product's competitiveness. They assessed competitiveness using costs, product prices and profit ratios. They also discussed product's quality, but quite evasively without no empirical assessment. However, Honfoga [31,32] empirically evaluated the quality of fertilizer and marketing services to assess the 'quality index – cost relationship' in the liberalized fertilizer business. No such study was done so far on food products, nor was the import parity price used.

This paper attempted to fill that double gap (empirical assessment of food quality, import parity price) to enable a valid comparison between imported rice and local rice. It paid attention to several quality attributes that are relevant to consumers in order to calculate quality grade values that would permit a valid comparison of the two types of rice using the quality/price ratio, which is a key empirical indicator of competitiveness.

2. MATERIALS AND METHODS

The competitiveness of the three types of rice (local indigenous, local factory-processed, and imported) was assessed using two main indicators: the market-gate cost price and the quality/cost price ratio. These simple competitiveness indicators were calculated for the three types of rice, and each type of locally-processed rice was compared with the imported rice. They were derived from market-gate cost price components (production and marketing costs) and quality attributes.

2.1 Sampling and Data Collection Methods

Structured questionnaires were used to conduct interviews with a sample of 56 local rice value-chain actors, including: the Glazoué rice state-factory manager, 25 women "indigenous paddy processors" in Glazoué (center of the country) and 30 rice consumers in Glazoué (15) and Cotonou (15). Usually, the women process paddy using the indigenous parboiling technique. Paddy is parboiled by the women and is husked

by private mills' operators; the output is parboiled rice, which the women clean and take to the markets.

The 25 paddy processing-and-trade women were randomly chosen in 6 sub-districts, after the latter were randomly selected from the 10 sub-districts that compose the district of Glazoué. The women were selected based on household random pointing or random draw from a list of households. They were known to extension agents as resident paddy processors. The 30 consumers were met and selected using a kind of "boule-de-neige" or snowball sampling method[5]. They were asked whether they've ever cooked or eaten the three types of rice: local parboiled rice, factory-processed local rice, and imported rice. A "yes" answer qualified a consumer met on the spot for the survey. Then he/she was requested to rate the quality attributes for each type of rice, as already listed on the questionnaire. Thereafter, the next consumer was selected the same way and interviewed on the spot (or after an appointment) until the required number of interviewees was obtained. This was done the same way for consumers in the production region (Glazoué) and the metropolitan city (Cotonou), the country's main consumption center. Although no a priori discrimination was made among consumers during the survey, those in Cotonou are exposed to all sorts of rice available and may know better the rice quality attributes. But local rice is less available there than imported rice. Overall, dealing with consumers from both areas was useful to get a quite complete view on consumers' preferences for quality attributes of the three types of rice.

Data used for calculating the market gate cost price were collected from interviews with the women processors who also trade the indigenous parboiled rice. They included: paddy purchasing price and costs of transportation, parboiling (and related works), taxes, etc. The factory also faced these costs, except those related to parboiling. On the other hand, the indigenous parboiled rice was sold in bulk to city wholesalers who handled packaging themselves, whereas the factory faced packaging costs directly. Regarding the import parity price, data used included CIF price[6] of imported rice, handling costs, taxes and port fees, and local transportation costs from port to the domestic selling point or market. They were collected from rice importing companies, and trade facilitation organizations such as the national handling

company ("*Société Béninoise de Manutention Portuaire*" – SOBEMAP) and the Customs Directorate in the Port. The import parity price was calculated for imported rice delivered in Glazoué market.

Data collected from consumers concerned mainly their evaluation of the quality attributes of each type of rice, including physical and organoleptic characteristics of crude or cooked rice based on their tastes and preferences. There were 7 distinct attributes, including: cleanness, rate of broken rice, degree of whiteness, cooking speed[7], swelling after cooking or water absorption ability at cooking[8], taste/palatability, cohesion/grains' stickiness or texture of cooked rice.

2.2 Method of Data Analysis

Cost-wise competitiveness was evaluated first, using service costs and product price data. A comparison was made between market-gate cost prices of rice locally-produced by each type of processing facility, and the import parity price of imported rice. The Student T test was used to assess the significance of differences between average values. However, cost-wise competitiveness assessment is not enough. Indeed, one should consider at least the 'quality/price' ratio commonly used in marketing and public discourses for a more meaningful assessment of competitiveness[9]. Here, an empirical application was made of the concept of 'quality/price' ratio, using the 'quality index/cost price' ratio. Full price of final product (including production and distribution costs, and profits along the value chain) was not used because declared profits data are usually unreliable and would not be comparable between local actors

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[5]*Snowball sampling is a non-probability sampling scheme through which one begins by (purposively) sampling one person and then –through this person– obtains a list of persons who have the same characteristics as the initial persons selected and so on. In our case, the next person interviewed is not always designated by the previous one. A 'meet on the spot' approach was rather used.*
[6]*CIF = Cost, insurance and freight.*
[7]*Slow or long duration of cooking increases energy costs.*
[8]*According to interviewees, rice with high water absorption capacity is perceived as economical as the quantity of crude rice needed to feed one person is reduced.*
[9]*Here we are discussing only product's competitiveness and not firm's competitiveness. In addition to the former, the latter would also include the firm's market penetration (trends in sale volume, market share, etc.), frequency of market supply, leadership's smartness in market negotiations, and many other business attributes.*

Table 1. Method of quality index (%) calculation for a given quality attribute Y of rice type X [1/]

Quality grade (Gi)	% of respondents (Pi)	Observed scores (PiGi)
Not good		
Moderately good		
Very good		
Total observed score (∑PiGi)		
Average score (AS)	$AS = \dfrac{\sum_{i=1}^{3} P_i G_i}{\sum_{i=1}^{3} G_i}$	
Quality index (%) = 100*Average score/Maximum score [2/]	100*AS/50 = 2AS	

1/ X = private mill-processed indigenous parboiled rice, factory-processed white rice, imported rice; Y = any of the following attribute : cleanness, rate of broken rice, degree of whiteness, cooking speed, swelling after cooking or water absorption ability at cooking, taste/palatability, cohesion/grains' stickiness or texture of cooked rice. Blank cells are data filling zones.
*2/ Maximum score is: (maximum percentage of respondents*maximum quality grade)/sum of grades = 100*3/6 = 50*

operating informally and importers who are registered traders and are exposed to domestic taxes and uncertain foreign business environments.

Therefore, the following variables were calculated for the different types of rice: quality average scores and quality indexes for each type of rice; market-gate cost prices and 'quality index/market gate cost price' ratio for locally-produced rice; import parity price at Glazoué market and 'quality index/import parity price' for imported rice. Primary survey data were codified and entered with Epi data 3.1 and processed with Excel and PASW statistics (SPSS 18.0).

The quality index was computed with the view to compare the three different types of rice over the above-mentioned 7 quality attributes and a range of quality grades. Therefore, consumers were requested to give points to each attribute using the scale 1 – 3. For example, the attribute 'cleanness' was assessed as follows: 1=not clean, 2=moderately clean, 3=very clean). A total score was then calculated for all the 7 attributes, paying well attention to reverse gradient attributes such as 'rate of broken rice' or 'cohesion' (too much stickiness is not accepted). The quality average score (AS) is the weighted average of percentage of respondents (P_i), the weights being the declared quality grades (G_i). The quality index is the ratio 'average score (AS)/maximum score', the maximum score being 50 (Table 1 above). This method of index calculation derives from the formula: Index = (Observed score – Minimum score)/(Maximum score – Minimum score) [33,34]. In this research, the observed score was the calculated average score, and the minimum score was zero.

3. RESULTS AND DISCUSSION

3.1 Quality-wise Competitiveness

The quality assessment survey revealed that rice consumers usually prefer clean and white color rice, with low rate of broken rice. They would also like to eat delicious rice i.e. with very good taste/palatability, and with high water absorption ability at cooking or swelling after cooking. A short cooking time is also desired, as it allows time and energy saving. Fig. 2 summarizes the findings in terms of quality index comparison between rice types by quality attribute.

It appears that the SONAPRA[10] factory-processed rice, hereafter called SONAPRA rice, overtakes the private mill-processed indigenous parboiled rice regarding whiteness and cleanness which are highly valued by consumers for the choice of crude/non-cooked rice. Likewise, the SONAPRA rice overtakes the indigenous parboiled rice for taste/palatability and texture of cooked rice which are key for the choice of cooked rice by consumers. On the contrary, the indigenous parboiled rice is better than the SONAPRA rice regarding the 'broken rice ratio' attribute. Finally over the 7 quality attributes, the average quality index was 74.2%, 53.2%, and 79.6% respectively, for SONAPRA white rice, indigenous parboiled rice and imported rice (Table 2).

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[10]*SONAPRA (« Société Nationale pour la Promotion Agricole ») is the State Board of Agricultural Products (especially cotton and other non-food crops). It was a state monopoly since its creation in 1983, until its status changed after agricultural markets' liberalization in the early 1990s. By then, its monopoly on cotton export was removed, but the government subtly recovered that monopoly since 2013, while its buying activities are now extended to main cereals (maize, rice).*

Therefore, the SONAPRA rice is quality-wise more competitive than the indigenous parboiled rice. The factory-processed rice largely reduces the quality-wise competitiveness gap of local rice vis-à-vis imported rice (Fig. 3). Indeed, it corrects the indigenous rice's weaknesses previously revealed by VECO West Africa [25] and Adégbola and Singbo [10]. However, these authors did not make any quantitative quality assessment. In addition to the high quality of imported rice, other competitive advantages which local rice producers ought to strive for would include regular presence of the product on all periodic markets, variety of rice types, and good linkages with traders.

3.2 Cost-wise Competitiveness

3.2.1 Cost prices of the two types of locally-processed rice

In 2012-2013, indigenous paddy-processing women bought paddy in their villages and neighborhoods at prices ranging from 120-240.6 FCFA/kg, with an average of 192.92 FCFA/kg. On the contrary, the SONAPRA industrial factory buys paddy at assembly points in Glazoué district and other districts in the 'Collines' sub-region at a fixed price of 150 FCFA/kg. At mill gate, paddy price may go higher than at factory gate because some women collect paddy from numerous scattered farms and bear high transportation costs. On the contrary, average paddy processing/husking cost at private mills (17.92 FCFA/kg of paddy) is lower than that of the factory (30 FCFA/kg) because the latter supports high energy costs and pays salaries for permanent workers. However, several hand works (including artisanal parboiling and outsourced services) increase the mill-gate cost of indigenously-processed local rice (Table 3). On the contrary, the factory realizes economies of scale during paddy procurement and slightly reduces many hand works at processing stage, through internal integration via machines instead of outsourcing. Indeed, it does not produce parboiled rice which entails many hand works. Yet, it bears high packaging costs which paddy-processing women do not face or pay for. They sell their rice in bulk to wholesalers.

Overall, average market-gate cost price of mill-processed indigenous rice is 374.02 FCFA/kg, and 302.43 FCFA/kg for the SONAPRA factory-processed rice. Fig. 4 shows that 28% of women produce the mill-processed rice at high cost price (350-400 FCFA/kg) and 40% at very high cost (400-450 FCFA/kg), in comparison with the average cost. Therefore, the SONAPRA factory-processed rice is less expensive than the mill-processed indigenous parboiled rice. The industrial factory thus brings down processing costs and enables a 19.1% reduction in market-gate cost price of locally-produced rice.
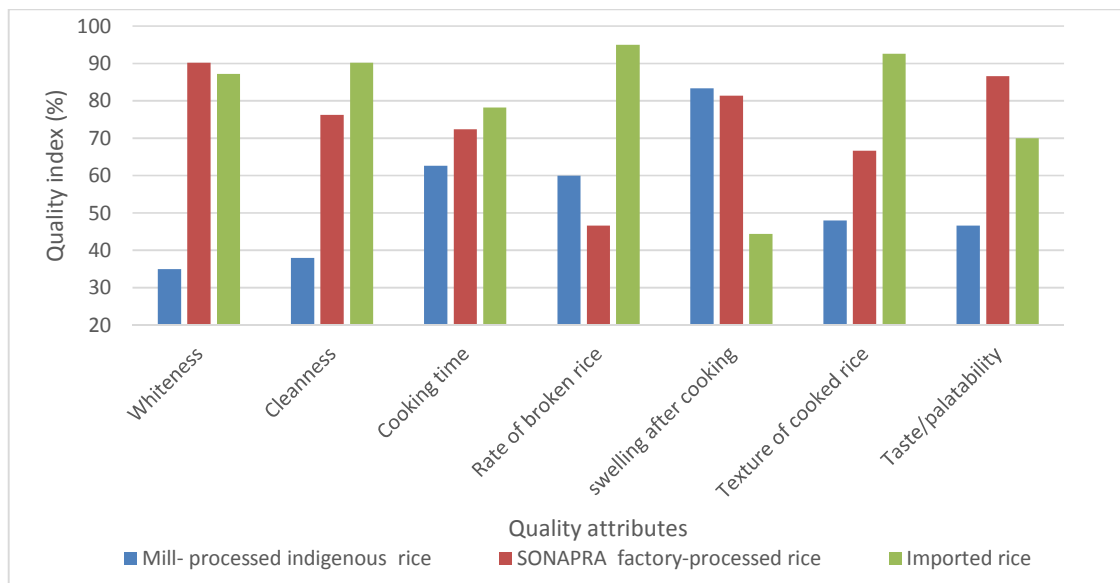

Fig. 2. Summary of consumers' assessment of rice quality attributes
Source: Computed from field data (2012)

Table 2. Quality index (%) of the three types of rice by quality attributes

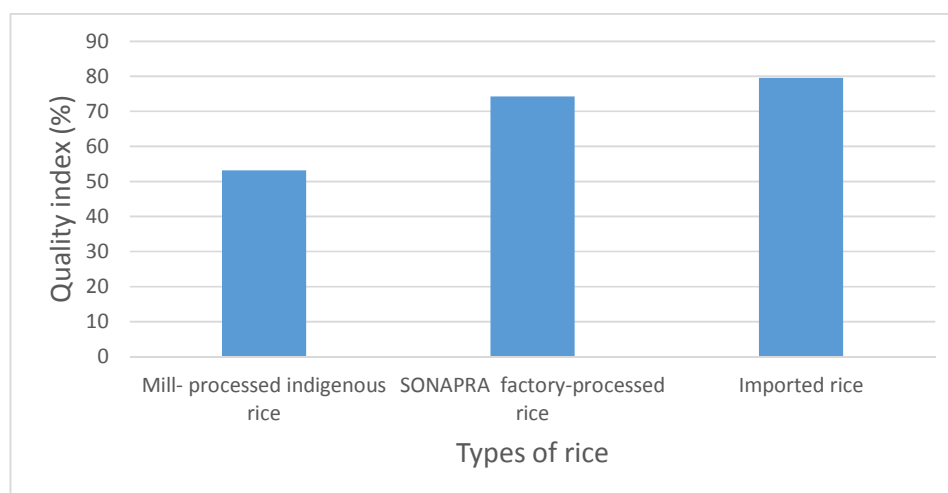| Quality attributes	Indigenous parboiled rice (mill- processed)	SONAPRA rice (factory-processed)	Imported rice
Whiteness	35	90.2	87.2
Cleanness	38	76.2	90.2
Cooking time	62.6	72.4	78.2
Rate of broken rice	60	46.6	95
Swelling after cooking	83.4	81.4	44.4
Texture of cooked rice	48	66.6	92.6
Taste/palatability	46.6	86.6	70
Average	53.2	74.2	79.6

Source: Computed from field data (2012)

Fig. 3. Quality index of local rice and imported rice
Source: Computed from field data (2012)

Table 3. Market-gate cost prices of mill-processed and factory-processed local rice

Cost items (for 1 kg of product)	Indigenous parboiled rice (mill- processed)	SONAPRA rice (factory-processed)
	FCFA/kg	
Paddy processing yield [a]	0.64	*0.65*
Paddy purchasing price	192.92	150
Paddy collection and assembly [b]	3.27	--
Paddy processing-related services (parboiling, drying, sorting, winnowing)	20.72	0
Husking	17.92	30
Sub-total for processed rice before packaging [c]	366.92	276.92
Packaging of processed rice		20
Distribution	7.1	5.52
Market-gate cost price of processed rice [d]	374.02 (n= 25, s= 45.33)	302.44 (n=1)

a- Processing yield is the 'processed rice/paddy' weight ratio; thus FCFA/kg does not apply here.
b- Not applicable. This costs are integrated in the husking cost, as declared by the factory officials.
c- This sub-total is equal to the sum of above values divided by the paddy processing yield.
d- Cost price means the processing firm's profit is not included. Here it is average value calculated from the sample: n = 25 women, based on declared minimum and maximum values of cost items; s is the standard deviation. n=1 means there was only one industrial factory investigated. It is the only one that exists in the region.
--: not available.
Source: Computed from field data (2012)

3.2.2 Import parity price of imported rice, compared to local rice cost prices

Table 4 presents the breakdown of the import parity price of imported rice, delivered at Glazoué market-gate. The average import parity price (281.30 FCFA/kg) is lower than the cost price of each type of locally-produced rice (374.02 FCFA/kg for the private mill-processed rice and 302.44 FCFA/kg for the SONAPRA factory-processed white rice). The Student T test indicates that the differences between these average cost prices are statistically significant at 5% level. This means the two types of locally-produced rice are more expensive and thus less competitive cost-wise than the imported one. This result confirms previous research findings [23,10]. It also shows that the cost competiveness gap is about 33% for the private mill-processed rice and only 7.5% for the factory-processed rice. Therefore, the modern factory provides a significant cost-wise competitive gain of 25.5 percentage points over the indigenous paddy processing facilities (indigenous parboiling, private milling, and several other hand works).

3.3 The 'Quality Index/Cost Price' Competitiveness Assessment

Based on the results in sections 3.1 and 3.2, 'quality index/cost price' ratio is calculated for local rice, and the 'quality index/import parity price' ratio for imported rice. In the latter case, the import parity price stands for a cost price. From the results in Table 5, it appears that the 'quality/cost price' ratio decreases from 0.28 for imported rice to 0.25 for SONAPRA factory-processed rice and drastically to 0.14 for the mill-processed indigenous parboiled rice.

The above results indicate that the industrial paddy processing brings down the competiveness gap of local rice vis-à-vis imported rice from 49.72% (indigenous parboiled rice) to 13.13%, i.e. a more than 4-fold increase in competitiveness (Fig. 5).

However the SONAPRA rice faces serious market linkage problems. Indeed, that rice is presently sold only by ONASA (the national food security agency) through government pilot shops where only the poor is supposedly allowed to buy, but a strict rationing prevails to prevent several sales to a same person. Yet, this rationing seems to hide a corruption system. Some observers reported that stocks remained unsold because not many people could have access. These stocks were finally sold at low 'rescue' prices, and they may then be captured by illegal traders who practice foreign rice label substitution, and thereby cheat largely on consumers by selling the local rice at high prices of imported rice.
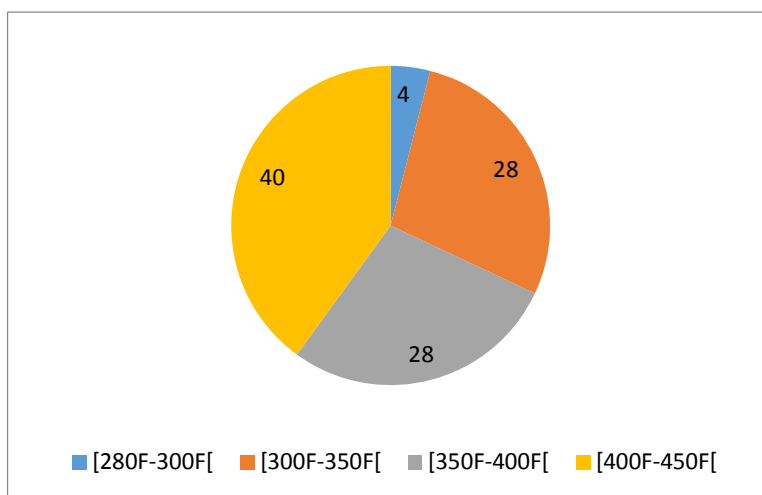

Fig. 4. Relative importance (%) of cost price ranges of mill-processed indigenous rice
Note: Values in square brackets are cost price values. Those in the pie chart areas are % of respondents (consumers).
Source: Computed from field data (2012)

Table 4. Import parity price of imported rice, delivered at Glazoué market

Cost items	Cost (FCFA/kg)
CIF price (international import price) (A)	**183.30**
Port and customs fees (B)	**70.00**
Port and insurance fees	3.64
Custom fees 35,5%	66.36
Local transport and handling charges (C)	**28.00**
Transport within Cotonou (importer, wholesaler, semi-wholesaler)	7.50
Transport Cotonou-Glazoué	20.50
Import parity price of imported rice at Glazoué market (D)	**281.30**

D = A+B+C.
Source: Computed from field data (2012).

Table 5. Differential competitiveness gaps of local rice vis-à-vis imported rice

	Indigenous parboiled rice (mill- processed)	SONAPRA rice (factory-processed)	Imported rice
Quality index (%)	53.2	74.2	79.6
Cost price or import parity price (FCFA/kg)	373.95	302.43	281.3
Quality index/cost price ratio or Quality index/import parity price ratio	0.14	0.25	0.28
Competitiveness gap vis-à-vis imported rice (%)	49.72	13.13	-

- : Not applicable
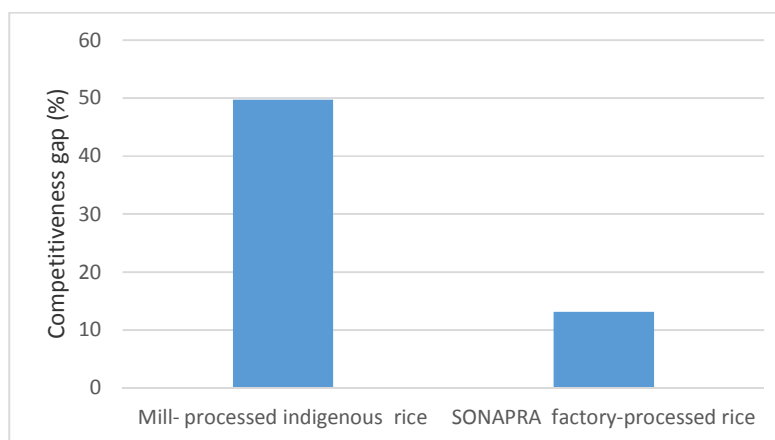*Source: Computed from field data (2012)*

Fig. 5. Differential competitiveness gaps of local rice vis-à-vis imported rice
Source: Computed from field data (2012).

4. CONCLUSION AND POLICY IMPLICATIONS

This research assessed the product's competitive gains of the modern paddy husking/processing factory installed by the government in Glazoué district, compared to private mills that were already operating in the area. Competitiveness of locally-produced rice vis-à-vis imported rice was evaluated, with particular attention to quality index, market gate cost price, and quality index/price ratio. The findings reveal that the indigenously-produced rice was not competitive compared to the imported rice. However industrial paddy processing via the SONAPRA factory enabled a more than 4-fold increase of local rice competitiveness. Therefore, more public investment in such factories should be promoted if rice produced in Benin Republic is to gain large

11

shares in domestic and regional markets. However, market linkage issues remain to be addressed by the SONAPRA management in order to ensure greater access of consumers to its rice, the quality of which competes quite well with the imported rice. On the other side, processing and marketing capacities of women and private millers need to be enhanced, provided that the parboiled rice has a growing market. The specific market outlets of each type of local rice should be developed. Finally, for equity concerns, further research is needed to assess the impact of public investment in modern factories on incomes of rice farmers, women rice processors-traders, private millers, and on overall well-being of rural households.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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