



An Estimation of the Determinants of Efficiency of Rice Farmers in Benin: A Case Study of the Departments of Mono and Couffo

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Abstract

Rice is an important component in the quest for food security in Benin, but its production remains low and thus needs to be optimized. This study estimated technical as well as allocative efficiency and identified the sources of the inefficiency of rice farmers in Benin, with specific focus on the departments of Mono and Couffo. The study used secondary data obtained from the Ministry of Agriculture, Livestock and Fisheries. The data covers 210 rice farmers evenly spread out within the departments of Mono and Couffo. The Cobb-Douglas production frontier method was used to measure the level of technical efficiency of farmers, while allocative efficiency was examined using

the marginal product value method. The results reveal that the technical efficiency of producers is at 78%, and that there are therefore possibilities of increasing rice production. The sources of inefficiency are age, sex, the level of education and access to finance. The results also revealed the existence of allocative inefficiency in rice cultivation. Manpower is overused whereas other production factors such as seeds, pesticides, and fertilizer are underutilized. Allocative efficiency is explained by sex, age, the area sown, the type of crop, and access to finance. These results indicate that rice farmers in the departments of Mono and Couffo would benefit from adapting the best agricultural practices such as the use of fertilizer, agro-chemical products, and irrigation.

Introduction

In Benin, the introduction of rice among the staples goes back to the colonial period, but rice farming really started in the post-independence period, during the 1960s with the establishment of state-run rice farms. Due to an increase in the population of Benin by 2.9% between 1979 and 1992, and by 3.2% between 1992 and 2002, and by 3.5% between 2002 and 2013 (National Institute of Statistics and Economic Analysis [INSAE], 2013), the national consumption of rice increased by 7,000 tonnes in 1960 to 265,000 tonnes in 2010 and to 729,000 tonnes in 2017 (United States Department of Agriculture [USDA], 2018).

Rice demand increased, and the average consumption which was at the level of 3-4kg per capita and per year in the 1960s increased to 12kg per capita and per year in 2004 then 25-30kg per capita and per year in 2011 (National Strategy for Rice production (SNDR, 2011) and to 45.7kg per capita and per year in 2017 (Strategic Plan for the Development of the Agricultural Sector [PSDSA], 2018).

Despite the increase in national production of paddy rice from 1,000 tonnes in 1960 to 80,000 tonnes in 2010 and to 179,000 tonnes in 2017 (USDA, 2018), the national production of rice is still not sufficient to meet the local demand. It only covers 25% of rice consumption (USDA, 2018). The consumption gap is therefore filled through imports (including the percentage share of re-exportation) which has increased from 6,000 tonnes in 1960 to 195,000 tonnes in 2018 (USDA, 2018). Rice imports lead to heavy losses in terms of foreign exchange, which was estimated at US\$293 million in 2018 (USDA, 2018).

The Strategic Plan for the Development of the Agricultural Sector (PSDSA, 2018), for Benin, listed the promotion of rice cultivation among the priority sectors that need to be addressed. Thus, rice is one of the food crops the government of Benin is depending upon to ensure food security and poverty reduction to meet the Sustainable Development Goals (SDGs).

The set target is to achieve rice cultivation of 72,960 tonnes of rice paddy by 2007 and 600,000 tonnes (equivalent to 385,000 tonnes of white rice) as from 2015 to ensure self-sustainability in rice production and have a surplus for trade exchanges by 2018. However, the national production of rice, estimated at 234,145 tonnes of paddy in 2015, is far from the objective of 600,000 tonnes of paddy in 2015. Rice yields have oscillated around 3 tonnes per hectare since 2003. This is far below the potential yields, which are estimated at between 3 tonnes and 10 tonnes per hectare depending on the varieties and the production system (Ministry of Agriculture, Livestock and Fisheries [MAEP], 2009). This situation demonstrates that there are tremendous opportunities for the improvement of rice yields in Benin.

An increase in the cultivated area, the promotion of good-quality rice seeds, access to fertilizer and to agro-chemical products, an improvement of access to finance, the improvement of agricultural equipment and strengthening of outreach services (SNDR, 2011) are strategies that the governments have used to improve access by small-scale farmers to production resources and thus increase rice production in Benin. Regarding these actions, this study addresses the problem of the efficient allocation of production resources. This point of view has been supported by authors of previous studies (Yabi, 2009; Kinkingninhoun-Medagbe et al., 2010; Singbo & Lansink, 2010; Amoussouhoui et al., 2012; Zannou et al., 2018) who demonstrated that there is at least 16% inefficiency regarding rice production in Benin. For example, Yabi (2009) evaluated technical efficiency of rice producers in Benin at 0.82. Kinkingninhoun-Medagbe et al. (2010) estimated technical efficiency of producers of irrigated rice at 0.84. Singbo and Lansink (2010) demonstrated that there is 35% inefficiency in rice production in lowland rice production in Benin. These studies clearly reveal that rice producers in Benin would benefit from a better and more efficient use of production resources.

Rice cultivation was introduced to the departments of Mono and Couffo in 1976. Rice cultivation is mostly undertaken on small-scale units that are run by families. Besides these family-run units, there is developed land, whereby irrigation utilizing either drip irrigation or total submersion in water is used. Most of these rice farms are in lowlands, whether developed or not. Rice cultivation has not really picked in the region, despite the possibility of transforming this to large-scale production given the abundance of water resources. From an evaluation of the performance of rice growing areas in various departments of Benin, we observe that the region of Mono-Couffo recorded the lowest productivity.

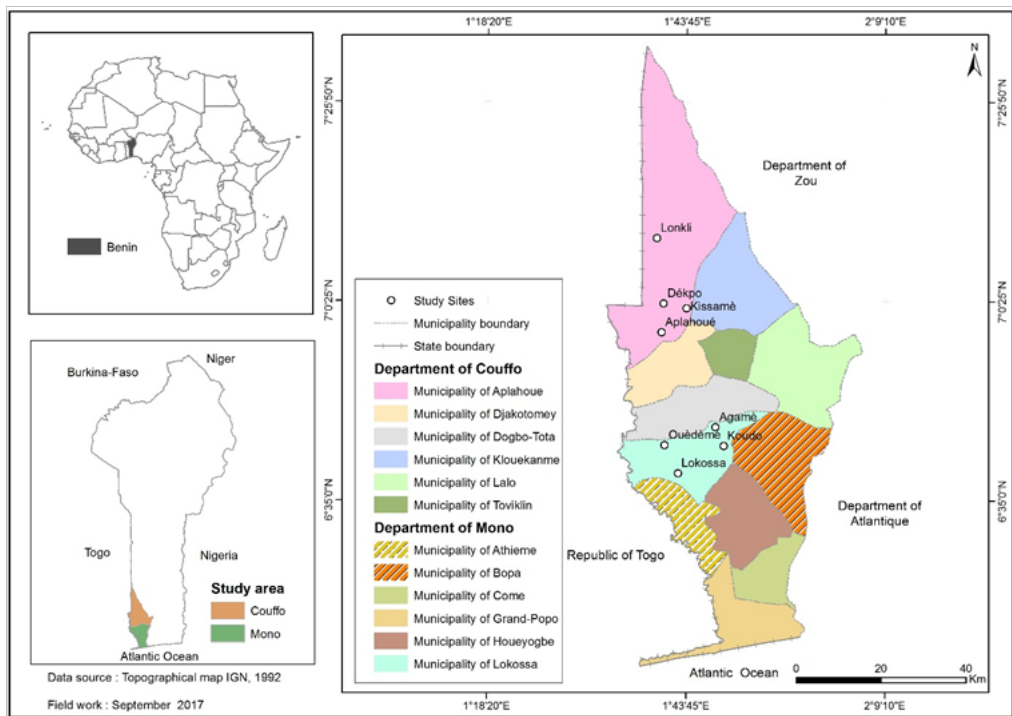
The total production in the region was 3,026 tonnes in 2015 against 6,032 tonnes in 2014 and 971 tonnes in 2001 (MAEP, 2018). However, in departments where there is large-scale rice production such as Atacora, Alibora and les Collines, rice production in 2017 was estimated at 143,507 tonnes, 130,193 tonnes and 49,456 tonnes, respectively (MAEP, 2018). Various interventions through the “Emergency Aid Programme for Food Security” (PUASA) and the “National Association for Agricultural Promotion

(SONAPRA)” in the departments of Mono and Couffo contributed to an increase in the total cultivated area from 316 hectares in 2001 to 1,101 hectares in 2015 (MAEP, 2018), but the level of production remains low. The food balance sheet of the Mono-Couffo region reveals that regarding low consumption, rice remains at a deficit by 5,932 tonnes in Mono and 7,336 tonnes in Couffo in 2017. This deficit is perennial and impacts upon meeting the demands of vulnerable groups. This leads to serious problems of having a malnourished population and lagged growth of children.

Thus, despite being a rice producer, Benin basically depends on foreign produce to meet its local demand for rice. To lower this dependence on global food markets, and to allow for rice to effectively play its role as a staple and thus contribute to food security and poverty reduction, it is important to optimize the systems of rice production; in other words, to improve the performance of production factors. Because agricultural land is not infinite, it is important to improve the efficiency of existing production factors to increase rice production. A study aimed at examining the efficiency of rice farmers and their determinants is therefore essential to put appropriate policies in place to support future endeavours that will promote the development of rice production in Benin in general and in the departments of Mono and Couffo in particular.

Our study contributes to economic research in various ways. Firstly, it provides support to future policies that will promote rice farming. This comes at an important moment because the domestic levels of rice production remain insufficient to meet the needs of the local population. Secondly, none of the previous studies (Yabi, 2009, Kinkingninhoun-Medagbe et al., 2010; Singbo & Lansink, 2010; Amoussouhoui et al., 2012; Zannou et al., 2018) on the efficiency of rice farmers in Benin were carried out in the departments of Mono and Couffo. Thirdly, in terms of empiricism, most studies did not take the matter of the heterogeneity of the regions into account. This study thus aims at filling these gaps.

To do so, it aims at providing answers to the following questions: What are the levels of technical and allocative efficiency of rice farmers? Which are the efficiency factors for rice farmers? The overall objective of this study, therefore, is to identify the factors which influence the technical and allocative efficiency of rice farmers in Benin. More specifically, the study aims to: (1) Estimate the level of technical and allocative efficiency of rice farmers; (2) Identify the determinants of efficiency of rice farmers in Benin; and (3) Determine to what level the models of technical and allocative efficiency are the same in the two regions (Mono and Couffo).

Figure 1: Map of the zone under study

Source: Field Work, 2017

The departments of Mono and Couffo were chosen for this study because: (1) they are among the regions with the lowest levels of rice production in Benin, (2) they comprise vast agricultural lands and hold agro-ecological potential for the cultivation of rice. Indeed, these departments are endowed with 17,000 hectares of lowlands that are available for rice production. To this could be added 27,000 hectares of flood plains. Despite these potentialities, the departments are characterized by high levels of food insecurity and poverty (Table 1) and are classified among the three poorest departments in Benin (INSAE, 2015). Much of the population is involved in subsistence farming and in other economic activities such as fishing, livestock, small businesses, and crafts. The main crops grown in the two departments are maize, cassava, cowpeas/beans, rice, tomatoes, pepper, okra, vegetables, cotton and palm oil. Rice production in the departments of Mono and Couffo is relatively higher than the average in the country. However, the farms dedicated to rice production are smaller than those in other departments such as Alibori and Atacora. This situation could explain the rice deficit observed in the departments of Mono and Couffo.

Table 1: Socioeconomic characteristics of the departments of Mono and Couffo

| | Mono | Couffo | Alibori | Atacora | Benin |
|--------------------------|--|--|--|--|---|
| Population (2013) | 497,243 | 745,328 | 867,463 | 772,262 | 10,008,749 |
| Rate of school enrolment | 52.1 | 39.6 | 17.5 | 26 | 43.1 |
| Main economic activity | Agriculture, fishing, livestock, small-scale business, trade, and crafts | Agriculture, fishing, livestock, small-scale business, trade, and crafts | Agriculture, fishing, livestock, small-scale business, trade, and crafts | Agriculture, fishing, livestock, small-scale business, trade, and crafts | Agriculture, fishing, livestock, small-scale business, construction, trade, agri-business, cement production and crafts |
| Main crop | Maize, cassava, cowpeas, rice, pepper, okra, vegetables, palm oil | Maize, cassava, cowpeas, rice, pepper, okra, vegetables, cotton | Maize, cassava, cowpeas, rice, cashews, cotton | Maize, cassava, cowpeas, rice, cashews, cotton | Maize, rice, beans, cassava, cotton, cocoa, pineapples, cashews, palm oil |
| Food insecurity (%) | 35.3 | 44.5 | 60 | 45 | 34 |
| Poverty rate (%) | 43.5 | 46.6 | 36.3 | 39.7 | 36.2 |
| Rice yields (kg/ha) | 3347 | 3127 | 3820 | 2568 | 3031 |

Source: INSAE (2011, 2015).

Data source

This study uses secondary type data. It is derived from the 2013 database of the Ministry of Livestock and Fisheries. This is information that is taken from technical and economic data collected from farmers during the agricultural campaign of 2012-2013 in the departments of Mono and Couffo by the regional council of rice growers (CRR) with the support of the Support Project for the Agricultural Sector of Mono and Couffo (FAFA-MC) and of CARDER-Mono-Couffo. CARDER collects information on the rainfall in three different areas of each municipality, and these are compiled at the departmental level. Before collecting data, the regional council of rice growers of the departments of Mono and Couffo undertook a census of rice growers in 2011. This revealed the presence of 3,282 rice growers of whom 64% are from the department of Couffo and 36% from Mono.

Based on this distribution of rice growers in the departments of Mono and Couffo, the technique of proportional sampling was used to obtain 210 growers. These regional surveys were developed to collect reliable information related to the socioeconomic characteristics of rice growers as well as the inputs used in rice production, to better understand agricultural practices and to give support to farmers in these regions.

Conclusion and policy implications

The objective of this study is to estimate technical and allocative efficiency and to identify the sources of inefficiency of rice producers in the departments of Mono and Couffo in Benin. The study uses a stochastic frontier approach to examine technical efficiency and the marginal value approach to examine allocative efficiency. Several conclusions could be drawn from this study: (1) Technical efficiency of rice growers is estimated at 78%; (2) Rice growers over-utilize manpower, and underutilize other production factors such as seeds, fertilizer, and pesticides; and (3) The sources of inefficiency are age, gender, level of education and access to finance by the rice grower. These results suggest that there is still room to improve the production of rice in the departments of Mono and Couffo. Thus, it is necessary to conduct periodic trainings for rice growers on best practices in production. Outreach services could play an important role in this sense. The improvement of the efficiency of producers is also achieved using agricultural technologies. It is, therefore, important to facilitate access to technology for rice growers. The efforts by the government and organizations that are involved in the sector should also be geared towards the promotion of agricultural finance. Access to finance is a key factor of development in the agricultural sector.

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