



## Production and marketing of rice (*Oryza sativa*) in the community - Tooli sector, Opala territory, Tshopo province. DR Congo

Maliani K<sup>1</sup>, Mbula LB<sup>2</sup>, Okungo LA<sup>1</sup>, Mukandama NJP<sup>3</sup> and Muanasaka KL<sup>1</sup>

<sup>1.</sup> Institut Facultaire des Sciences Agronomiques de Yangambi B.P. 1232 Kisangani, Democratic Republic of Congo

<sup>2.</sup> Bunia Business School

<sup>3.</sup> University of Kisangani, Faculty of Natural Resource Management B. P. 2012 Kisangani in the Democratic Republic of Congo

<sup>1</sup>Corresponding author

### Abstract.

In order to shed light on the distribution of income from rice cultivation and its impact on the well-being of farmers in the Tooli sector, Opala territory, research was carried out by surveying farm households growing rice in the study area.

The variables selected were: area sown; paddy production; quantity of paddy sold; income from paddy sales and allocation; poverty and social development variables, subsistence poverty and access to basic social services; geographical dynamics of access to water, energy, health and schooling; benefits from rice marketing; and housing structure.

On average, clothing, manufactured and other goods account for 40%, health 24%, transport 6% and education 30% of the total family budget. The shares for clothing and education are much higher.

The socio-economic benefits to farmers (rice growers) from the income generated by the sale of rice include: schooling for children, health care and the purchase of essential manufactured goods. In short, rice cultivation improves the living conditions of farmers.

**Keywords:** Allocation, Income, Impact, Rice, Well-being improvement, Tooli and Opala

Received 28 Aug., 2024; Revised 05 Sep., 2024; Accepted 07 Sep., 2024 © The author(s) 2024.

Published with open access at [www.questjournals.org](http://www.questjournals.org)

### I. Introduction

In terms of rice production, the Asian continent is the global leader. China is the leading producer, with a yield of 146.7 million tonnes in 2020, followed by Vietnam with 28.2 million tonnes and Thailand with 18.2 million tonnes in the same year (USDA, 2020).

In terms of rice consumption per person per year, Africa ranks second after Asia, with an average of 34.26 kg (FAOSTAT, 2023). In some West African countries, the average per capita consumption of rice has reached over 60 kg per year, with some cities exceeding 100 kg (Tondel et al., 2020). The urban population has a preference for rice over other cereals due to the shorter preparation time and easier storage (Lançon, 2011).

The demand for rice in Africa has increased markedly in recent decades, with projections indicating a potential fourfold rise by 2050 (Mendez del Villar & Bauer, 2013). This exponential increase in demand can be attributed to the high rate of demographic growth associated with the phenomenon of rapid urbanisation, which is accompanied by changes in lifestyles and food preferences (Naseem et al., 2013). Given that global production is relatively low, at just 5% of the world total in 2020, and that almost 20% of the world's population resides in African countries (FAOSTAT, 2023), it is inevitable that these countries must import rice to meet domestic demand. Imports have increased threefold between 2007 and 2019, representing a third of global imports, thereby rendering local production even more susceptible to imported rice (Mendez del Villar & Lançon, 2015).

The disruption to international trade caused by the corona virus crisis (Covid19) continues to demonstrate Africa's vulnerability in general (Arouna et al, 2020).

In the Democratic Republic of Congo, rice ranks second in cereal production after maize. The quantity of rice produced in 2019 was 1,378,846 tonnes, compared with 2,138,962 tonnes of maize. According to INS (2020).

Paddy rice production in the 2018 season was 457,479 tonnes and in the 2019 season 490,015 tonnes, an increase of 6.64% on the base year (2018). Paddy rice production in Tshopo Province in 2018 was 119,602 tonnes and 128,108 tonnes in 2019, an increase of 7.11% on the previous year.

As well as providing a livelihood, rice earns a certain amount of income for all those involved in the sector: growers, transporters, processors and traders. World rice trade in the 2018-2019 season was down by around 8% on the previous season, at 42.6 million tonnes, as a sharp contraction in demand from Asian origins far outweighed a modest increase in shipments to sub-Saharan Africa (OSIRIS in France AgriMer, 2020).

In the DRC, rice growing is still the preserve of small-scale producers, who cultivate an average of 0.50 ha of rainfed land and 0.20 ha of irrigated land, producing less than 0.5 and 0.6 tonnes of paddy respectively (INS, 2018).

The marketing of rice, like any other agricultural product, enables it to be transferred from the place of production to the place of consumption. It is therefore a series of interconnected activities involving: production planning, cultivation and harvesting, sorting, packaging, transport, storage, distribution and sale. Such activities cannot be carried out without an exchange of information and are often highly dependent on the availability of adequate funding (Vernin, 1998).

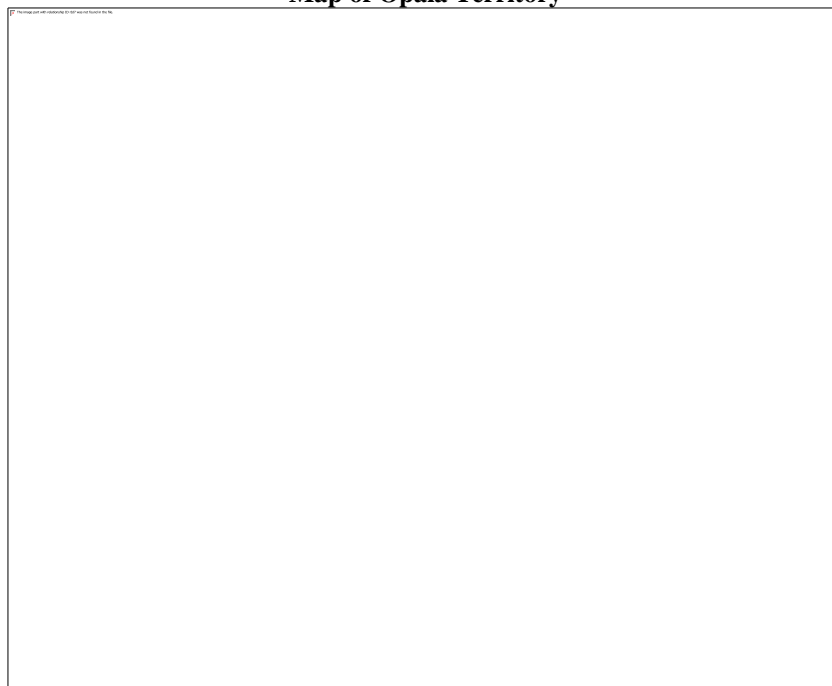
Marketing systems are dynamic. They are competitive and involve continuous change and improvement. The activities that prosper are those that generate lower costs, are more efficient and can supply quality products. Those that generate high costs, fail to adapt to changes in market demand and supply inferior products often go out of business. Marketing must be geared towards consumers and generate a profit for the grower, transporter, trader, processor, etc. This implies that the players involved in the marketing chains understand the buyer's requirements, in terms of product and economic activity. Rice farmers in the study area produce rice primarily for sale, so it is important to know what the income from this activity is used for. Although the Mbole grow rice, their staple food is cassava and plantain. The main question that this study seeks to answer is as follows:

What would be the allocation of income from this activity at the household level of the stakeholders that could be used as an investment fund in the environment?

The income from this activity would be used to pay for children's schooling, health care, the purchase of material goods - in short, for the socio-economic development of those involved in rice marketing. Determine the allocation of income from rice cultivation and the impact on improving farmers' well-being.

## **Environment ; Materials and methods.**

### **Map of Opala Territory**



Our study was carried out in the Territory of Opala, the capital of which is located 278 km from Kisangani, in the Tooli collectivity-sector.

Opala is one of seven territories in Tshopo province, including Bafuasende, Banalia, Basoko, Isangi, Opala, Ubundu and Yahuma.

Opala lies between latitude 0° 20' North and latitude 1° South of the town of Kisangani (the urban-rural commune of Lubunga) on either side of longitude 24°.

Naturally, the territory is bordered to the north by the territory of Isangi, to the south by the territory of Lomela (dismembered Kasai Oriental), to the east by the territory of Ubundu and to the west by the territory of Ikela (dismembered Equateur Province).

The climate is of the equatorial type, characterised by two short dry seasons from January to February and June to July, and abundant rainfall the rest of the time, with an average rainfall of 1,800 mm. According to KÖPPEN, this is an Af-type climate, with an average temperature of 25.2°C at night and 30-31°C during the day. The average relative humidity is 70° to 80°C (Annual Report, 2004).

In addition to Lobaie, there are other major rivers: Etoli, Lokana, Lombo, Lokilo, Elila and several streams.

The dominant vegetation is that of the dense, primary and luxuriant equatorial forest with its diversity of species. The secondary forests are also remarkable. Opala's forests are home to some of the world's rarest animal species, including the Okapi, the Congo peacock and primates such as Makobola (the only one of its kind).

The choice of the Tooli district as our study area is based on its largest population, estimated at 33,214 inhabitants, or 22.4% of the total population of the Opala territory (Service d'Etat-civil, territoire d'Opala, 2003).

The territory and the majority of its communities are characterised by their high agricultural potential. Natural factors such as climate and water have a major influence on agricultural production, particularly rice.

This community is made up of the following eight groupings: Yaikoli, Yakonda, Yatanda, Yawelo, Yatulia, Yaoka, Yaisa and Bokuma.

Our research was carried out in the following villages: Yahila (Yaikoli group) 104 km from Kisangani; Yaleko (Yakonda group) 25 km away; Yapehe (capital of the Yawelo group) 42 km from Yaleko, on an agricultural desert road; Yaongama (Yaisa group) 30 km from Yapehe on an agricultural desert road.

### **Equipment used**

To make this study feasible, we used the following materials: Survey notebook; Pen, pencil, eraser, marker; A4 duplicate sheets of paper; Survey questionnaire/farming households; Tape measure (decameter); Scientific calculator; Ordinary calculator; Laptop computer; White correction ink; Bicycle; Honda CB125 and Senke125 motorbike; Pair of scissors; Camera; Recorder.

## **II. Method**

### **Study population**

In this study, our study population consisted of farmers, i.e. the head of household himself and those living under his authority. Members temporarily absent from the household (for less than three months) were included in the household population. Visitors and people temporarily present in the household at the time of the study (less than three months) are not considered to be members of the household (Mucchielli, 1989).

In our case, the mother population refers to the inhabitants of the Opala territory, essentially made up of a single MBOLE tribe from the Tooli sector community. This is an agricultural population that also hunts and fishes. Our study focuses on farming households, rice producers and those who trade in paddy.

### **Data sources**

Theoretically, the main sources of data for an economic study are publications, accounts and surveys (Darpoux and Roussel, 1972).

For this study, we used documentary data and surveys.

### **Documentary data**

We made use of publications to collect data, since publications are one of the sources for carrying out an economic study. Archives of previous statistics gave us an idea of the evolution of rice production in our study area.

### **Surveys**

To carry out our surveys, we used the quantitative method to collect data.

### **Choice of sampling method**

We used the simple random sampling method. We had an exhaustive list of the parent population. The sample was drawn from this list, taking care to ensure that each item on the list had the same probability of being included in the sample. The sample size was 30 households per site (group or village).

We used this list to carry out a random survey from which we drew a completely random sample using a table of numbers.

In practical terms, we are using a multi-stage survey (groups: 1<sup>er</sup> stage; villages: 2<sup>ème</sup> stage and households: 3<sup>ème</sup> stage).

#### **Choice of groups and villages**

At the first level, all the groups in the Collectivité-Secteur Tooli have been numbered.

At the 2<sup>ème</sup> level, villages were selected in the same way as groups.

#### **Data collection techniques**

The questionnaire was administered individually to farm households in the various villages.

Drafted in French, the questionnaire was orally translated during its administration into Lingala, Swahili or the local language as required. Most of the questions were closed and some were multiple choice.

#### **Specification of variables**

For the purposes of this study, we selected the following variables: areas sown; paddy rice production; quantity of paddy sold; revenue from paddy sales and allocation, poverty and social development variables, subsistence poverty and access to basic social services, geographical dynamics of access to water, energy, health and schooling, benefits from rice marketing and housing structure.

### **Data collection**

#### **Area sown**

The area sown is a production factor whose size determines the size of harvests on a traditional farm. (Timberlake, 1988).

We know from the theory of agricultural economic space that the further farms are from a consumer market, the less intense the production of marketable products, all other things being equal (Guigou, 1970).

Indeed, if this is the case, farmers tend to substitute cash crops for cash crops, as transport costs take the place of profit, putting out of economic reach any production that could be developed in remote areas.

The area under cultivation varied according to whether it was primary or secondary forest and the size of the household.

In our study area, to determine the area to be sown, each head of household has a roll of nylon thread 100 metres long, with a knot every 10 metres. He also has two stakes.

Nylon wire is used for measuring, while stakes are used to align the area to be sown.

During our assessments or sporadic checks, we used the tape measure (roll).

For a field with a recognised regular geometric shape, the known formula is used (e.g. square:  $C^2$ ).

For a field with an irregular geometric shape, the triangulation method was used.

#### **Paddy rice production**

After harvesting, the panicles are dried in the sun. The panicles are then threshed.

The quantity of paddy rice (all the grains) obtained is weighed to determine the actual weight. This operation is mainly carried out when a customer (buyer) arrives.

Often, a measuring container is used: a bucket or a bag whose contents (weight) have already been tested (approximate weight); for example 10kg for a bucket and 100kg for a bulging bag.

So, at the end of the harvest, the entire production will be known.

#### **Sold production of paddy rice**

In our research environment, the production sold is the difference between the production achieved minus the quantity consumed by the members of the household and the part given to third parties who carried out the harvest as payment in kind.

We then calculate  $QV * PV$  (1°)

With QV: Quantity sold

PV: Selling price

#### **Revenue from paddy rice sales**

This was the revenue (in cash) realised after the sale of the quantity of paddy rice made available by the farmer for the commercial transaction.

Formula:  $R = Q_o * P$  (2) ; With R: Revenue ;  $Q_o$  : Quantity offered and P: Price

#### **Statistical analysis**

We used Tukey's Multiple Comparison of Means Test to calculate the averages of the areas sown to fields, the rice yields obtained, the quantities of paddy sold and the revenue from paddy sales.

The results obtained are summarised in the following tables:

### III. Results And Discussion

#### 1. Area sown and paddy rice production

The average values for the area sown and production per village surveyed are shown in Table 1.

**Table 1.** Average field area and average production in relation to study sites

Villages	Area of fields (ha)	Rice production (t)
YAHILA	0,440 <sup>b</sup>	1,275 <sup>b</sup>
YALEKO	0,659 <sup>b</sup>	0,945 <sup>b</sup>
YAPEHE	1,446 <sup>a</sup>	2,386 <sup>a</sup>
YAONGAMA	0,708 <sup>b</sup>	1,230 <sup>b</sup>
Meaning (p)	0,0000 <sup>***</sup>	0,0000 <sup>***</sup>

Means with equal letters, no significant differences for  $p > 0.05$  according to Tukey's Multiple Comparison of Means Test; p: probability

0.0000<sup>\*\*\*</sup> : very highly significant differences At the 5% significance level, the Tukey Multiple Test for Comparison of Means shows highly significant differences ( $p = 0.0000^{***} < 0.5$ ) between the areas sown to rice fields on all the sites. The same is true of the average paddy rice production at the 4 sites.

These yields are lower than those obtained by Evens (2013) in Haiti by comparing two rice-growing systems (Traditional and Irrigated). Evaluated at 3.542 and 4.860 t/ha respectively. These differences are due to the environment, the cropping systems and the varieties tested.

**Table 2.** Average weight of paddy rice per field and average revenue in relation to the study sites

Villages	Quantity of paddy sold (kg)	Income from paddy sales (FC/kg)
YAHILA	423,33 <sup>b</sup>	249210,0 <sup>b</sup>
YALEKO	636,83 <sup>b</sup>	35385,0 <sup>b</sup>
YAPEHE	1414,67 <sup>a</sup>	778066,01 <sup>a</sup>
YAONGAMA	687,33 <sup>b</sup>	378011,0 <sup>b</sup>
Meaning (p)	0,0000 <sup>***</sup>	0,0000 <sup>***</sup>

Means with equal letters, no significant differences for  $p > 0.05$  according to Tukey's Multiple Comparison of Means Test; p: probability; 0.0000<sup>\*\*\*</sup> : very highly significant differences

The Tukey Multiple Comparison Test of Means shows at the 5% significance level highly significant differences ( $p = 0.0000^{***} < 0.05$ ) between the quantities of paddy sold (Kg) in the 4 sites. The same is true for paddy sales revenue (FC/Kg).

#### 1. Allocation of income from rice cultivation

Income allocation can be used as an indicator of a population's level of development, helping to identify the shortcomings of a society so that it can be helped to fill these gaps. It also shows how a farm household distributes its income.

Income allocation was analysed on the basis of spending over the last three months on the main household expenditure items in our study area. Overall, in our study area, clothing, manufactured goods and other goods of value accounted for an average of 40% of total family budgets, followed by health (24%), transport (6%) and education (30%). The proportions for clothing and education are much higher.

#### 2. Poverty and social development variables

For almost a decade now, the issue of poverty has been high on the agenda of many governments in developed and so-called "non-advanced" countries. The Democratic Republic of Congo has incorporated the growth objective into its strategic document (Poverty Reduction Strategy Paper - PRSP).

To understand the reality of poverty, poverty measurement often refers to the notion of a threshold below which individuals or groups of individuals can be considered poor. It should also be emphasised that the most widespread approaches are those that allow for monetary valuation, as this is relatively easier to assess. The variables taken into account are synthetic. They relate to the level, expenditure and consumption per individual or per household.

For our part, in order to assess the extent of this phenomenon, our observations approach the question of poverty from the angle of access to the satisfaction of basic social needs in our study environment, since it is true that the assessment of poverty should not be reduced to the simple expression of a minimum, whether physiological or otherwise, which can be converted into a daily calorie intake, for example. It is a more complex phenomenon

that must take account of the satisfaction of several needs. Throughout this chapter, we look at access to basic social needs as a function of location. We look at access to health, education, water and other primary needs.

### **1. Poverty and access to basic social services**

The "living conditions" approach involves assessing aspects of poverty on the basis of material conditions in everyday life. This approach gives an idea of poverty over time, as opposed to monetary variables subject to cyclical variations (such as income or expenditure). It is therefore a non-monetary approach that looks at the issue from the point of view of results rather than means (Rizafindrakoto and Roubaud, 2000).

### **2. Geographical dynamics of access to water**

The Democratic Republic of Congo is richly drained by freshwater over almost its entire territory. Paradoxically, however, it is poorly served in terms of drinking water. Only 22% of the population, or 12%, live in rural areas. Various surveys and epidemiological analyses show that the poor state of the environment is the cause of more than 80% of cases of disease in the Democratic Republic of Congo (DSCR, 2006).

It should be noted that no geographical area of Opala is currently supplied with running water from taps on the traditional water distribution network.

### **3. Geographical dynamics of access to energy**

The energy sector is characterised by a striking paradox between the country's enormous potential and the low level of household access to electricity. In total, the country has an estimated potential of 100,000 MW, i.e. 13% of the world's hydroelectric potential; unfortunately, the total installed capacity in 2000 was only 2,516 MW, i.e. only 2.5% of the total potential. The current rate of household access to electricity, estimated at 6%, is one of the lowest in Africa (Beltrade-Congo, 2012).

Biomass fuels are the most popular source of energy in the Democratic Republic of Congo. These include firewood and charcoal. Firewood is mainly used to cook food in rural areas, with harmful consequences for the environment and human health.

The Opala area has no access to electricity. All households use firewood for cooking. The uncontrolled collection of firewood in the forest represents a major threat to this ecosystem, in addition to those caused by the practice of slash-and-burn felling. The fuelwood harvested comes mainly from dead, dry tree branches or trunks and slash-and-burn residues. There is little processing of wood into charcoal in this area. Palm oil is by far the most widely used source of lighting. These are makeshift lanterns made from tin cans, with old cloth used to carry the flammable liquid. The light produced is dim.

### **1. Geographical dynamics of access to healthcare**

Health is a publicly funded private consumer good (Denis, 2006). In advanced countries, most healthcare expenditure is financed by social protection bodies, and in particular by the Social Security system. The World Health Organisation (WHO, 2010) refers to the notion of well-being when it talks about health. It is a primary need, essential to biological life and to physical, mental and even social well-being. Satisfying this need requires recourse to healthcare which, unlike health (which cannot be measured), has a cost (which can be measured). Whether or not we are able to meet this need therefore reflects, to some extent, our level of vulnerability or resilience.

According to WHO Afro (2009), the curative care utilisation rate in the Democratic Republic of Congo is 38%, and the average bed occupancy rate is 34.9%, instead of the recommended minimum of 50%.

In the Opala area, particularly in the Tooli community-sector, the majority of the population has enormous difficulty accessing health care in hospitals. The peasants make do with traditional treatments, which in some cases nevertheless produce interesting results, thanks in particular to the use of traditional medicine. They use wild medicinal plants of which they have a certain mastery. For some, however, this is purely a matter of dependence on local beliefs and traditions, which are very deeply rooted in the area. For others, on the other hand, it's because of the high cost of certain medical procedures, on the one hand, and the remoteness of these health institutions, on the other. It is important to point out that there is no mutual health insurance scheme, let alone adequate social structures to support the population.

### **2. Access to schooling**

The key role of education in the growth process was already recognised by Adam Smith (1976). However, it was Schultz (1961) who introduced the concept of human capital, which is built up by generating resources.

The role of education is to provide basic cognitive skills such as literacy and numeracy. Education also provides important generic skills such as teamwork and communication.

And most professions require a mix of different skill types with a specific level of aptitude within each, which only education can provide.

Unfortunately, it has to be said that in the Opala area, neither the quantity nor the quality of schools is sufficient. From the point of view of the relevance of training courses, it is worth noting that in the whole of the territory, there is only one agricultural technical institute at Yatolema (90 km from Kisangani).

Overall, according to the IPST report (2020), the school enrolment rate is 81.8%. This declines with distance from the city. The dropouts recorded are largely due to the high cost of school fees (77.4%). Pregnancy came second, accounting for 12.09% of cases, followed by long distances to school. The pregnancy-related drop-out rate is higher in the most remote areas. This reinforces the low level of schooling among girls (66.6% not attending school). The lack of schooling for girls in the Mbole environment can be explained by several factors: the first relates to the "housewife" concept of women. They have to stay at home and take care of domestic chores. So, when incomes are low, boys are favoured over girls. As well as working in the fields, girls can also do other jobs. Secondly, in Mbole tradition, early marriage is, to a certain extent, a secure source of income for the family through the payment of the dowry.

### **1. Overview of the habitat in our study area**

Housing conditions are generally deplorable. They are characterised by a degree of promiscuity within households. Communal rooms are often single, although more or less large. There are hardly more than three bedrooms. It should be noted, however, that life is spent outdoors, with the house used more as a shelter from the elements, mainly rain, and for sleeping. Cooking is generally done in the open air on the plot. Hygiene facilities are set up in a corner of the plot, some distance behind the house. These facilities serve both as toilets for relieving oneself and as showers. They are generally holes dug in the open air, but surrounded by straw, to preserve as much privacy as possible. Most of the houses are built of adobe. The baked brick houses covered with metal sheets are prestigious features but also ensure the durability of the dwelling.

### **2. The socio-economic benefits of rice marketing for farmers**

Rice farmers use the proceeds from the sale of rice to send their children to school and pay for health care. They buy basic necessities (soap, salt, coffee, tea, sugar, pharmaceutical products, clothing, etc.).

They manage to buy energy sources (solar panels, generators) and other valuable goods such as furniture, sheet metal, radios and televisions. There are also a number of means of transport (motorbikes, bicycles). Small shops (trading in a variety of goods) have been set up thanks to the proceeds from the sale of rice. Generally speaking, rice-growing has improved the living conditions of the farmers. However, there are many constraints that hamper the development of this crop.

Small-scale farmers are essentially farming households who rely on their small family members for rice production activities, and sometimes get help from relatives or neighbours (village solidarity). They use hoes and machetes and apply slash-and-burn farming methods, without chemical fertilisers. Some households use hired labour during clearing, sowing, harvesting and threshing.

The area per farm varies from 0.5 to 3 hectares. Generally speaking, the family rice growers in our study area are still poorly organised and structured. They are not yet capable of promoting and undertaking activities of common interest.

On average, rice growers earn between 249,210 and 778,066 FC per cropping season (from clearing to harvest). This sum of money, which is expected to last more or less 6 months, cannot cover most of the farmer's (rice grower's) needs, especially as he is often indebted to commercial intermediaries for pre-financing. It is thanks to secondary activities (hunting, fishing) that the farmer holds out.

It is important to note that the rice variety grown in the Opala area is a 6-month crop variety, "Kitombe" (IRAT 111), whose genetic degeneration has led to a significant drop in yield from 1.5 t/ha to 0.5-0.8 t/ha. Despite this low productivity, farmers remain very attached to it, thanks in particular to the fact that this rice is highly prized in Kisangani, the main consumption centre, because of its puffiness and good conservation after cooking. Other characteristics that contribute to the attachment of Opala farmers to the traditional variety include the low rate of bird attack due to B, its good shelf life, and its relatively easy sale on the market.

## **IV. Conclusion**

The aim of this study was to determine the allocation of income from rice cultivation and the impact on improving the well-being of farmers in the Tooli district of Opala.

We used random sampling to obtain a sample of thirty farm households per site (village) in our study area. We also used the documentary method to gather more information about our study.

Our constant is that the agro-economic factors, Tukey's Multiple Comparison of Means Test shows that the averages of areas sown to fields, rice production achieved, quantities of paddy sold and income from paddy sales show highly significant differences ( $p = 0.0000^{***} < 0.05$ ).

Overall, in our study area, clothing, manufactured goods and other goods of value consume on average 40%, health 24%, transport 6% and education 30% of total family budgets. The proportions for clothing and education are much higher.

The structure of the rice market in our study area is oligopolistic, which proves that there is an imbalance between demand and supply, resulting in the enrichment of crooked intermediaries who are few in number and well informed about various market parameters.

The different price levels for marketing local rice show that wholesalers (commercial intermediaries) have the highest profit margin, i.e. a financial return of 75%.

The socio-economic benefits to farmers (rice growers) from the income generated by the sale of rice include: schooling for children, healthcare, and the purchase of essential manufactured goods. In short, rice-growing improves the living conditions of farmers.

### References

- [1]. ALBARELLON, L., 1987 : effets sociaux des sondages d'opinions, Ed. Economica, Paris, 186 p
- [2]. AROUNA, A., SOULLIER, G., MENDEZ DEL VILLAR, P., & DEMONT, M. (2020). Policy options for mitigating impacts of COVID-19 on domestic rice value chains and food security in West Africa. *Global Food Security*, 26(May), 100405. <https://doi.org/10.1016/j.gfs.2020.100405>
- [3]. BEAND, S., and WEBER, F., 2003: "Guide de l'enquête sur terrain, Ed. La découverte, Paris, 143 p
- [4]. Bwama, M.M., (2005), Etude socio-économique des stratégies du développement de la Région d'Opala, Mémoire de DES. IFA, 83 p
- [5]. CHAMBERS. R., 1990: "Développement rural: la pauvreté cachée", Ed. Karthala, Paris, 87 p.
- [6]. CHANTAL, B., BONNE MAISON. J., BOUTRAIS. J., et LASSAILLY, 1984: "Le développement rural en question" paysages, espaces ruraux, systèmes organes, Ed. de l'arstom, Paris, 258 p.
- [7]. CHONCHOL, J., 1986: "Paysans avenir. Les sociétés rurales du tiers monde" Ed. Karthala. Paris, 179 p
- [8]. COUTOIS, G., NIQUET. G., and LOCHARD. J., 1982: "Comprendre la comptabilité analytique". Ed. DU BOIS, Paris, p.15
- [9]. DAGNELIE, P., 1975: "Théorie des statistiques" vol.2. Ed. Les Presses agronomiques de Gembloux, p.133