



Contribution of the technologies introduced by ENABEL to improving the rice-growing value chain at Banalia Territory, Tshopo - RDC.

Patrick BATSUMIRWA WASINGYA^{1 3 *}, Francis KEMPAY¹,
Grégoire MAMBA^{1 2}, Godefroid MONDE^{1 2}, Jonas NGOY¹

⁽¹⁾ Faculty Institute of Agronomic Sciences of Yangambi PO Box 1232 Kisangani, Democratic Republic of Congo

⁽²⁾ Central and West African Virus Epidemiology (WAVE), Kisangani, Democratic Republic of Congo

(*) Auteur correspondant

SUMMARY

The overall aim of this study was to investigate the introduction of new technologies by ENABEL to improve the rice value chain in the Banalia area. At the end of this investigation, we analysed the different types of rice milling technologies, their yield, and the profit they generate for the beneficiaries.

The surveys were carried out in Tshopo Province, specifically in Banalia Territory, and the results of these studies show that:

The analysis of the results shows that :

- The UFF takeover achieved a higher profit of USD 1,658.4 in 2022, followed by the AMANI takeover.

- In the case of UFF, for example, the active members of this association shared out 60% of the profits in 2022, i.e. an amount of USD 1,472,524.

It is clear that OPAs' profits, sales, gross and net margins have declined over time, resulting in a profit of:

- For the Amani takeover bid with a profit of \$1,138.3 in 2022 compared to \$0 the following year.

- For the BASULE Women takeover bid, with a profit of \$843.72 in 2022 compared with \$722.4 in 2023.

- OPA Pain pour la vie, here the profit was \$663.9 in 2022 compared to \$489.2 in 2023.

- OPA Pamoja tu Jenge, the profit was \$ 141.7 in 2022 against \$ 85 in 2023 ;

- OPA CUAM, earned \$819.9 against \$101.89

- UFF's takeover bid gave it a profit of \$1,844.4 in 2022, compared with \$1,472.5 in 2022.

- OPA ASCIDEAZ had realised \$1,239.6 in 2022 against \$1,607.9 in 2023

There are several possible explanations for these results, but what really caught our attention was the fact that, after the project ended, most of the local partners were unable to sustain the project's achievements.

Key words: Contribution, Technology, milling, rice, Enabel, Banalia

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I. INTRODUCTION

Rice is the staple food of many of the world's populations, particularly in most tropical countries, mainly in Asia, but also in South America, the Caribbean islands and Africa why not.

In the more productive sectors, alongside the large modern rice mills, which are sometimes not very profitable, many small-scale processing units have been developing for some years (Cruz, 1999).

Africa ranks second after Asia in terms of rice consumption per person yearly, with an average of 34.26kg (FAOSTAT data3). In some West African countries, average per capita consumption has reached over 60kg yearly, and exceeds 100kg in some cities (Tondel, at all 2020).

Rice is more preferred than other cereals by the urban population because of its shorter cooking time and easier storage (Lançon, 2011). The demand of rice has risen sharply in Africa in recent decades, and forecasts indicate that it could increase fourfold by 2050 (Mendez, et al 2013). This explosion in demand is essentially due to the high rate of demographic growth associated with the phenomenon of rapid urbanisation, which is accompanied by changes in lifestyles and food preferences (Rushigira, 2023).

The DRC is classified as a Low-Income Food Deficit Country (LIFDC) and ranks 187th on the Human Development Index. It was also noted that 69% of Congolese in rural areas do not have access to drinking water and that 6,320,893 people are facing an acute food and livelihood crisis. The agricultural and rural sector is a priority in the DRC. However, this priority has been neglected, resulting in increasing poverty and a dramatic nutritional situation from 2000 to 2010. We also note a lack of resources, poor policies and a collapsed seed sector. (Mathunabo et al., 2019).

In terms of consumption, rice ranks seventh, accounting for 2.5% of the national demand. Kinshasa leads the way, consuming 27.6% of the national volume consumed (1995). It is followed by the former Orientale Province, Kasai-Oriental, Maniema and Nord-Kivu, with 18%, 10.3%, 7.5% and 6.1% respectively. Just the demand of Kinshasa town alone accounted for 33% of overall supply. Consumption has increased significantly in this highly urbanised province. For example, from 1975 to 2000, it rose from 4.91kg/capita to 13.26kg, an increase of 270%; that of imported rice rose from 3.50kg to 8.42kg, an increase of 240% (Tollens). Current global consumption is estimated at 6,233,222 tonnes of white rice for a population of 89 046 000 (UNICEF 2015 report).

The overall aim is to find out what contribution the introduction of new technologies has made to rice milling in Tshopo Province thanks to ENABEL.

The following specific objectives are also targeted as follow:

- 1) To present the socio-economic profile of the players benefiting from the technologies in the banalia region.
- 2) To characterise the machines and their performance and the capacity of beneficiaries to renew them.
- 3) To identify the factors that come into play when assessing rice milling products.

II. MATERIALS AND METHODS

Description of the study environment

Geographical location

Tshopo Province shares a common border, 3073 km long, with eight different provinces.

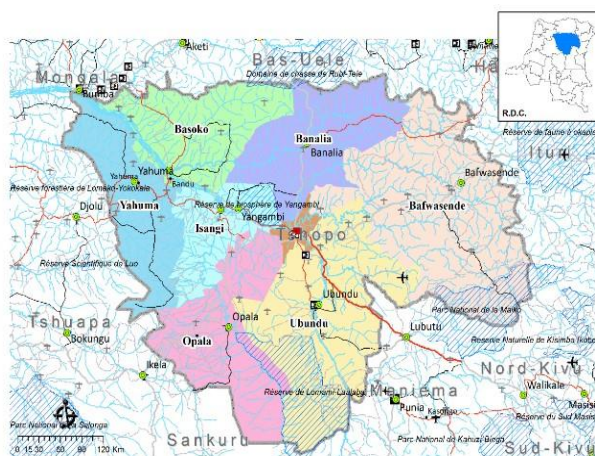


Figure 1: Location map of the study area²

² <https://presse.com/wp-content/uploads/2418/Carte-de-la-Provence-de-la-Tshopo.png> Consulté on 16/10/2022

Climate

The general climate in Tshopo Province is the equatorial or the humid tropical one. It corresponds to the Af type climate of the Köppen classification. The annual rainfall is characterised by an abundant, violent and somewhat aggressive precipitation, most often occurring in the evening. The annual rainfall average is around 1650-1800 mm. More abundant rainfall is nevertheless recorded in the south-west of the province, in the Yahuma territory, where a maximum annual rainfall of 2000 mm is recorded. However, this decreases towards the north-east, in a fringe of the Bafwasende territory, constituting a transition zone towards the Am-type climate. The atmospheric pressure is always low, and winds are very rare (UNDP/UNOPS 1998: 7).

Dominant vegetation

3 types of forest are represented in Tshopo Province:

- The dense equatorial rainforest: this covers the whole of the Tshopo administrative district, half of Bas-Uélé, Haut-Uélé (around 25%) and Ituri (Mambasa territory),
 - Savannah dotted with galleries or remnants of secondary forests: this is found as you move towards the north-east of the province and covers part of Haut-Uélé (Dungu, Faradje and Watsa territories) and Bas-Uélé (Poko, Ango and Bondo territories),
 - Heterogeneous highland vegetation: this covers most of Ituri Province (Lisingo, 2009).
- Since 2015, Tshopo province has been one of 26 provinces in the Democratic Republic of Congo, following the break-up of Province Orientale.

Population

According to a 2018 UNICEF report, the population of Tshopo is estimated at 2463,000, 61% of whom live in rural areas. An estimated 55% of the population is under the age of 18, and the average household size is 5.8 people.

This population has grown to around 2.5 million, according to another UNICEF report in 2021. This is the proof enough that the province is really experiencing a high dynamic demographic change, with the majority of the young population.

Method

To carry out this work, we have used the initial list provided by ENABEL to find out which associations had received donations of machines, the types of machines given to the OPAs and the location of these associations. This list of associations enabled us to obtain our sampling frame (N) and to characterise this distribution within the groups.

The method that helped us to carry out this work was a census.

Therefore, we wanted to compare the management methods of the farmers' organisations that receive processing kits from ENABEL and the various private companies that operate in their working environment. We therefore surveyed a total of 91 households. N= 91.

Data collection

This study has two parts:

- The retrospective study based almost entirely on analyses of secondary data collected from ENABEL and.
 - The prospective study, concerning the data that was collected in the field using the technique of personal observation; open questionnaire using the focus group (time for exchange with members of the OPAs).
- Table 1 below shows the breakdown of households surveyed according to the FBOs benefiting from processing units.

The chart 1. Breakdown of households surveyed by OPA (Farmer organisation)

N°	Farmer organization	Site/Kilometer	Households surveyed
1	AMANI	34	14
2	FEMMES BASULE	42	13
3	PAIN POUR LA PAIX	60	12

4	PAMOJA TUJENGE	62	13
5	CUAM	92	12
6	UFF	230	14
7	ASCIDEAZ (ZAMBEKE axis)	31	13
Total			91

The survey took place in July 2022 and November 2023 in the villages that had benefited from ENABEL's support in Banalia territory.

Processing and analysis of field survey data

For the second result, we used two statistical tests:

t (t-student) = normal distribution of data, in the case of Sales

W (Wilcoxon) = abnormal distribution of data = cases of gross margin, net margin and profit.

To analyse the data, we have used descriptive and inferential statistics to calculate position and parameter dispersion such as the arithmetic mean and standard deviation. Inferential statistics enabled us to perform the WILCON test. R and Microsoft Excel 2016 were used to process the data.

Analysis method

Faced to complex and random phenomena, decision-making is difficult, and the adapted tools of test theory are designed to guide choices between different alternatives. In general terms, the aim is to decide whether the differences observed between a model established a priori and the observations are significant or can be considered due to the simple effect of chance following the randomness of drawing a sample. Carrying out a statistical test involves implementing a procedure that Enable:

- 1) To confront a hypothesis to the reality, or more precisely, to what we perceive of reality through the observations available.
- 2) To decide following this comparison. While the problems dealt with by estimation (point or confidence interval) are quantitative, i.e. they lead to a numerical result, those dealt with by hypothesis testing are qualitative, i.e. they lead to a response of the type of rejection/acceptance of the statistical hypothesis under consideration. (Wikistat, 2024)

The variables have been grouped into two sections: socio-demographic and economic. To begin the statistical analysis, we checked the normality of the data using the Shapiro Wilk Test.

The very popular Shapiro-Wilk1 test is based on the W statistic. Compared to other tests, it is particularly powerful for small numbers ($n \leq 50$). The test statistic is written as :

$$W = \frac{\left[\sum_{i=1}^{\lfloor \frac{n}{2} \rfloor} a_i (x_{(n-i+1)} - x_{(i)}) \right]^2}{\sum_i (x_i - \bar{x})^2}$$

Where:

X(i) corresponds to the sorted data series; $\lfloor n/2 \rfloor$ is the integer part of the ratio $n/2$;

a_i : are constants generated from the mean and the variance-covariance matrix of the quantiles of a sample of size n following the normal distribution. These constants are provided in a second specific chart below.

The W statistic can therefore be interpreted as the coefficient of determination (the square of the correlation coefficient) between the series of quantiles generated from the normal distribution and the empirical ones obtained from the data. The higher W is, the more credible the compatibility with the normal distribution. The critical region, the rejection of normality, is written as:

R.C.: $W < W_{crit}$ the W_{crit} threshold values for different risks α and numbers n are read from the Shapiro-Wilk table. R. Rakotomalala (October 2011).

E. MORICE (1972) adds by saying that this test is based on the study of the ratio of the square of a certain linear combination of the incomplete ranges (i.e. of the differences of the ordered observations: $x_n - x_1, x_{n-1} - x_2, \dots, x_{n-j+1} - x_j, j < n/2$ to the sum of the squares of the deviations from the mean of the n observations (E. MORICE, 1972).

Also, in the case of the Gross Margin analysis, the P-Value 0.01 was found to be strictly less than 0.05, So, the Student's T test could not be used.

The WICOXON test was therefore used.

For the purposes of this study, our analysis model is summarised as follows:

$$Y = 68.55 + 1.71 * X1 - 0.51 * X2 + 0.49 * X3 \text{ with as:}$$

- Analysis method: Multiple linear regression with generalized linear model (glm)
- Dependent variable (Y) : Profit
- Independent variables (X): X1=Supplies, X2=Personal cost and X3=Taxes

III. RESULTS AND DISCUSSION

SWOT analysis of farmers' organisations in the Banalia area

The chart 2 : SWOT analysis in study area

<p>Strength</p> <ul style="list-style-type: none"> - Favourable agro ecology - Farmers organisations are made up of members who are farmers; - They have land; - They have benefited from training and are no longer in the dark thanks to Enabel; - Available manpower; - High demand 	<p>Weaknesses</p> <ul style="list-style-type: none"> - Most associations are set up by members of their families rather than capitalising on the strengths of the associations' members, particularly the steering committee; - Lack of management expertise; - In general, field areas remain family-owned (around 0.25 ha/household). - Low producer prices; - No group contract.
<p>Opportunities</p> <ul style="list-style-type: none"> - Support from ENABEL (provision of machines, construction of storehouse and other support) as well as support from other NGOs and INGOs; - Most OPAs are located on routes with maximum opportunities - Existence of improved varieties - 	<p>Threatened</p> <ul style="list-style-type: none"> - No agricultural credits ; - No solar or electrical energy; - Presence of private economic operators; - Taxes, - Poor road conditions; - The exorbitant price of fuel at the pump leading to soaring transport prices ... ; - Poor ICT services (poor communications Network coverage)

Source: field survey

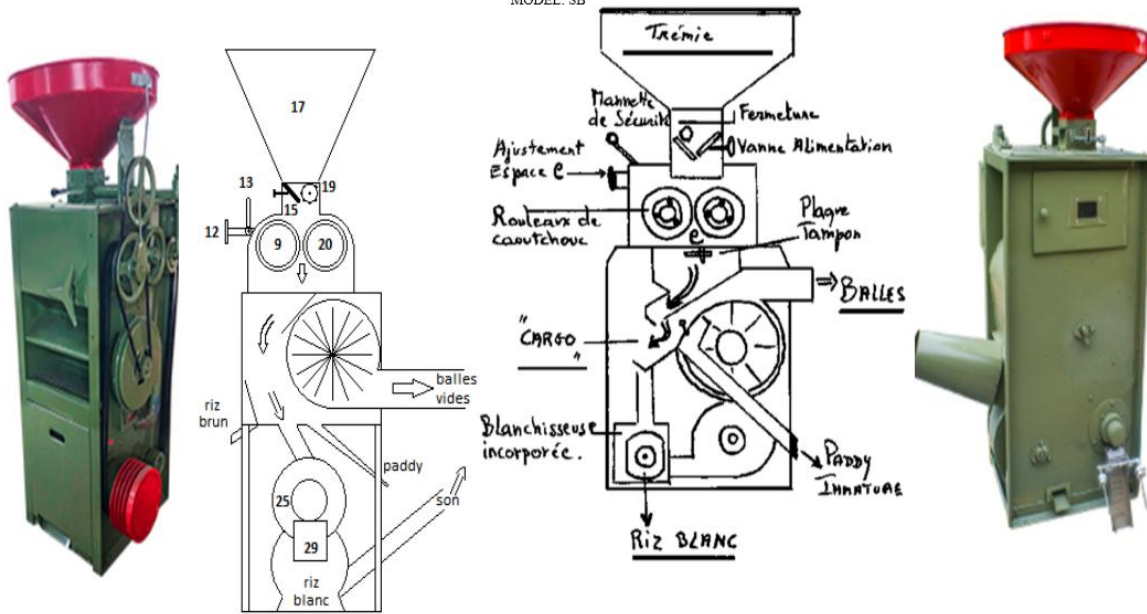
This analysis is on the line of the study carried out by Professor Baudoin Michel's team in 2019 on the competitiveness of local rice and options for improving it.

He also found opportunities in their study:

1. Existence of high-yielding plant varieties;
2. Presence of several support structures for rice production;
3. Possibility of developing numerous lowlands to control water management with two annual harvests;
4. Renewed interest in the sector from the Government and other development partners.

DECORTICATOR

MODEL: SB



MODEL N50 N70 N120

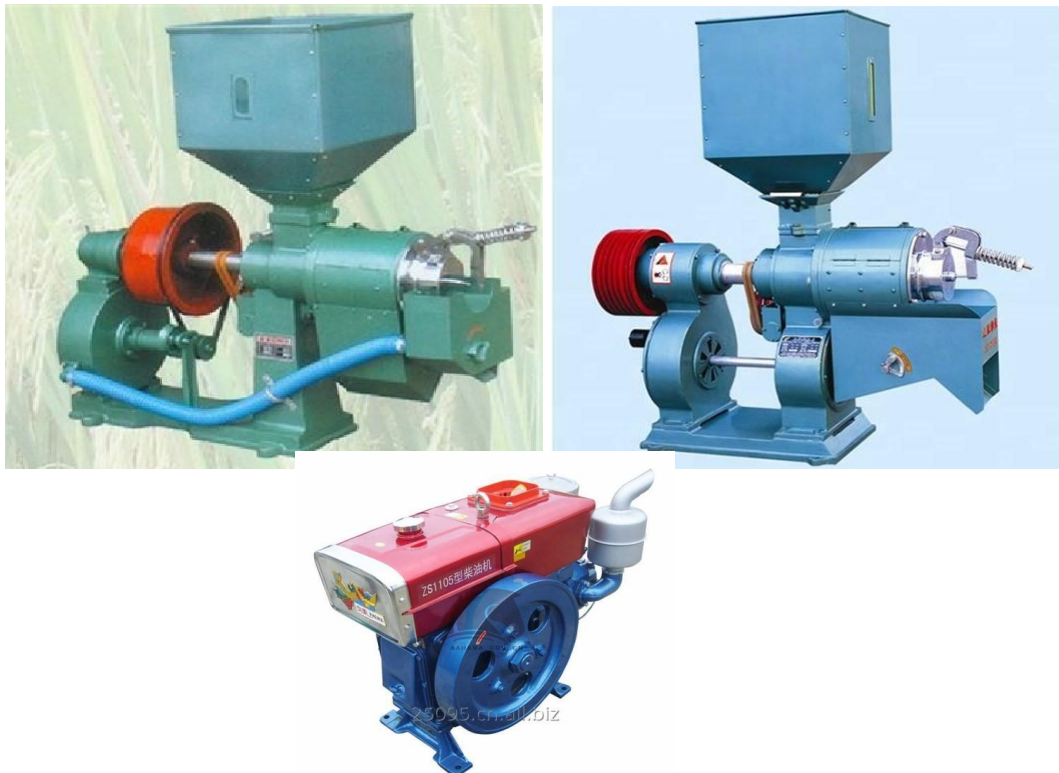


Photo 3 ,4 & 5 :
Model N50 and 70 as well as the Jang fa engine used by the Farmers

PRODAT's activities

In Tshopo Province, have led to an improvement in the productivity of the targeted crops, the construction of storage infrastructures and the setting up of processing units.

The storage infrastructures and processing units should be profitable for the members of the OPAs. The staff assigned to these various tasks have been trained by the project. Post-harvest losses have been reduced and the

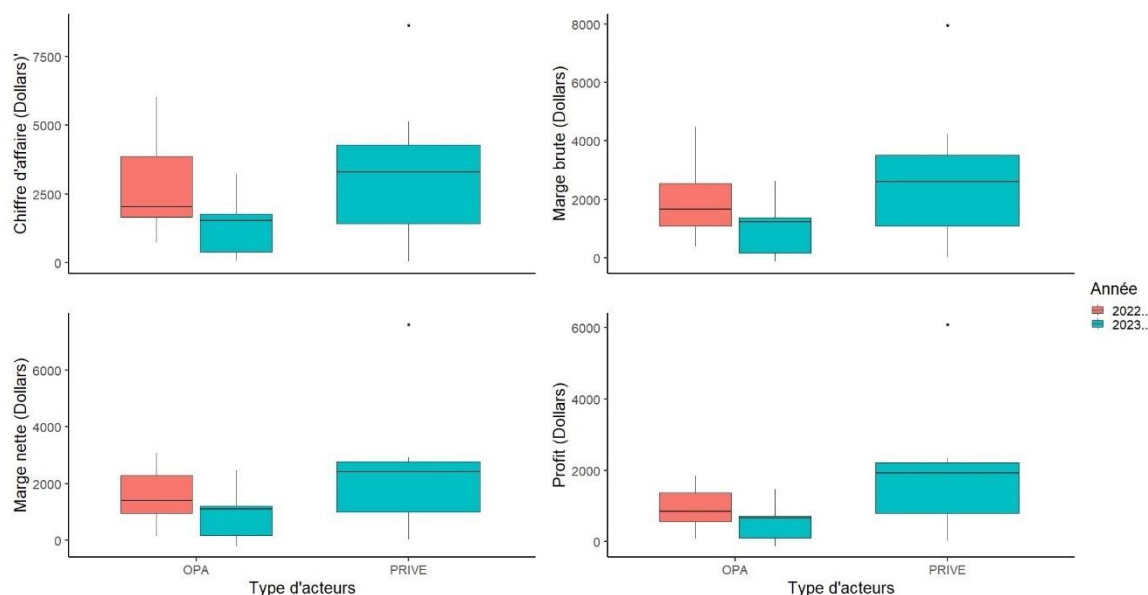
value has been added to products. However, it has been observed that the storage infrastructures and processing units are not managed profitably. (Mamadou & al ,2022)

Evaluation of the management of machining units by OPAs and the private sector

To make it easier to harmonise data collection, we used the following units

1 bucket worth 15 Kg

1 bag worth 100 kg, i.e. 8 buckets. In addition, the operators' management documents and the interviews enabled us to build up our database.



For result 1, , it is clear that OPAs' profits, sales, gross and net margins have declined over time.

This can be explained in various ways:

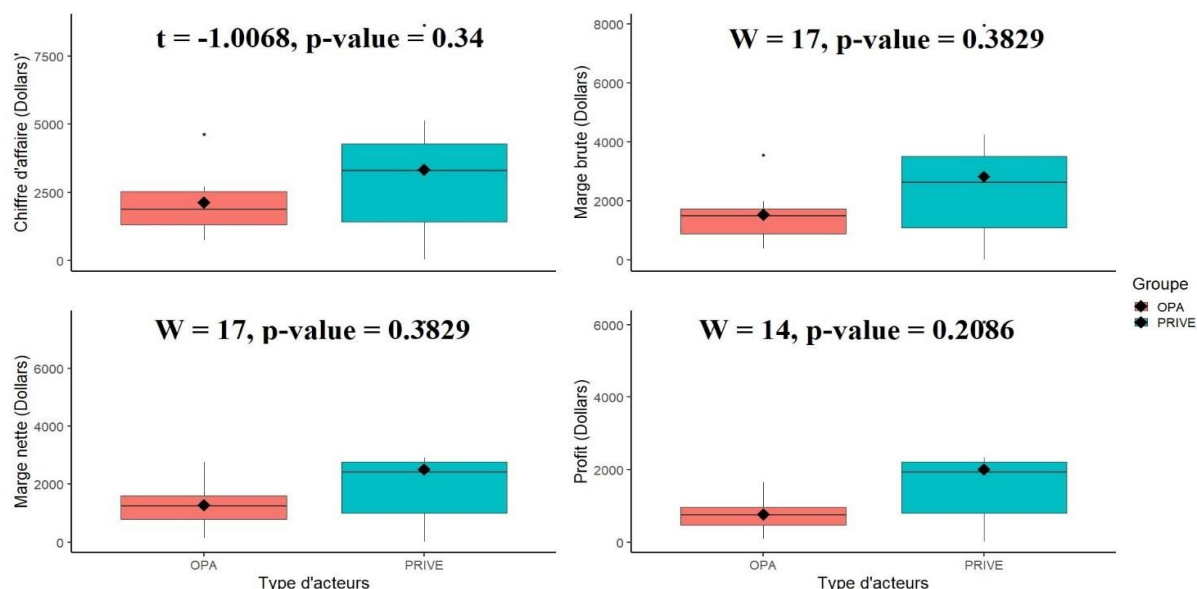
- The uncompetitiveness of farmers' organisations, which are almost always on standby to repair their machinery or finance their working capital. As a result, most farmers' organisations are unable to compete in the field with the private sector, which is investing heavily to clear the market.

- The problem related to maintenance:

- It has been observed in the field that the repair or maintenance of machines belonging to the OPAs poses a serious problem. After the training course organised by IITA in collaboration with ENABEL as part of its PRODAT project, more than 40% of the OPAs experienced a breakdown, either slight or serious, which sometimes led to the machine ceasing to operate.

Evaluation of the management of machining units by private economic operators

When we compared the way in which private operators and OPAs managed their machining units, we noticed the following, as shown in the graph below:



For the second result, we used the following two statistical tests: In view of these results, we used the t (t-student) because the distribution of the data was normal, for the case of Sales and W (Wilcoxon) = non-normal distribution of data for Gross, Net and Profit.

Overall, the statistical analyses revealed that there was no significant difference between the two types of players (OPA and Private) in terms of turnover, gross and net margin and profit. Nevertheless, in numerical terms and by observing the averages, it should be pointed out that the private players recorded better turnover, gross and net margins and profits than the OPAs, based on the 2023 year's data for the Players and the average between the two study years (2022 and 2023) for the OPAs.

CONCLUSION

This study aims to understand the contribution of the introduction of new technologies (machines) introduced by the Belgian agency ENABEL for the improvement of the value chain of rice cultivation in the territory of Banalia in the Tshopo Province.

The question we asked ourselves was what contribution these new technologies developed by ENABEL are making to Banalia region.

The overall aim of this study is to determine the contribution of technologies for improving the rice value chain in Banalia area.

Our study revealed the following result:

The analysis of the data in our possession relating to the income earned by the OPAs has shown that there are indeed players who contribute to the development of rice growing in the Banalia area.

The financial partner identified was ENABEL, and the beneficiary partners were the OPAs (farmers' organisations), which had received machinery and other support to ensure the success of their activities.

The machines given to the associations by ENABEL had proved their performance, but unfortunately some associations are unable to maintain these machines to remain competitive in the field. This situation doesn't allow some associations to compete with the private individuals who are in the field and who carry out their work with passion.

The results of the analysis revealed that:

- A. OPAs' profits, sales, gross and net margins have declined over time. Their net margins are as follows:
 - a) \$1,897 for the first OPA in year 1 compared to \$0 in year 2;
 - b) \$1,406 for the second OPA in year 1 compared with \$1204 in year 2;
 - c) \$524 for the third OPA in the first year compared to \$1106 in the second year
 - d) \$141 for the fourth OPA compared to \$0 in the second year.
 - e) \$1366 for the fifth OPA compared with \$170 in the second year;
 - f) \$3,074 for the sixth OPA, compared with \$2,454.2 in the second year, and
 - g) \$2,680 for the seventh OPA compared with -\$200.76 in the second year.

B. Using the, (t-student) test with a normal distribution of the data for the case of Sales and the W (Wilcoxon) test had revealed a normal distribution of the data for the case of Gross Margin, Net Margin and Profit. Overall, the statistical analyses revealed that there was no significant difference between the two types of player (OPA and Private) in terms of turnover, gross and net margin and profit. Nevertheless, in numerical terms and by observing the averages, it should be pointed out that the private players recorded better turnover, gross and net margins and profits than the OPAs, based on the 2023 data for the Players and the average between the two experimental years (2022 and 2023) for the OPAs.

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