Revue d'Economie Théorique et Appliquée - RETA ISSN : 1840-7277
Volume 2– Numéro 2 – Décembre 2025. pp. 313-328 eISSN : 1840-751X
https://doi.org/10.62519/reta.v15n2a13

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# Determinants of subsidy types and funding sources in the artisanal processing of palm nuts into red oil by women in southeastern Benin

***Summary***: This article examines the determinants of subsidy forms and financing sources in the processing of palm kernels into red oil in southeastern Benin. The study involved 312 women selected using a simple and purposive random method. A multivariate probit regression model was estimated. The results show that the use of self-financing and formal financing with in-kind subsidies are influenced by group membership and the processing system. Women's use of formal and informal financing with interest without subsidies is also affected by contact with an extension service and the number of active women in the household. Finally, in-kind subsidies and interest-free loans are positively influenced by the processing system, the warrantage system, group membership, and widowhood status.

**Keywords**: Financing – Subsid – Palm kernel – Southeastern Benin.

# *Déterminants des formes de subventions et des sources de financement dans la transformation artisanale de la noix de palme en huile rouge par les femmes au Sud-Est du Bénin.*

***Résumé*** *: Cet article a examiné les facteurs déterminants des formes de subventions et sources de financement dans la transformation de la noix de palme en huile rouge au Sud Est Bénin. L'étude porte sur 312 femmes choisis de façon aléatoire simple et raisonnée. Le modèle de régression Probit multivariée a été estimé. Les résultats montrent que le recours à l'autofinancement et le financement formel avec subvention en nature sont influencés par l'appartenance à un groupement, le système de transformation. Ensuite, le recours des femmes au financement formel et informel avec intérêt sans subventions sont affectés par le contact avec un service de vulgarisation, le nombre de femmes actifs dans le ménage. Enfin, les subventions en nature et des prêts sans intérêt sont influencées positivement par le système de transformation, le système de warrantage, l'appartenance à un groupement, le statut veuf.*

***Mots-clés :*** *Financement – Subvention – Noix de palme– Sud-Est Bénin*

***Classification JEL :*** Q14 - Q12 - O13 - O55.

*Received for publication: 20250914.* *Final revision accepted for publication: 20251230*

## 1. Introduction

Financial constraints in Benin agricultural sector are costly and unevenly distributed, seriously, by limiting the competitiveness of small farmers and processors (Assouto and Houngbeme, 2023). However, successful agricultural development requires "in fine" the gathering of appropriate financing to ensure steady and sustainable growth for farms. While financial support for small and medium-sized agricultural enterprises is available, there are few needs of these businesses. This problem also affects the palm oil sub-sector in Benin (Acclassato and al, 2021).

In addition, palm oil production has led to the development of several value chains. This sector offers the possibility to obtain many products mainly from palm nuts. These products include palm oil/ red oil. According to Sagna (2023), palm oil is the world's leading vegetable oil production. In Benin, this oil is used in the preparation of many local dishes. The processing of palm nuts is an activity mainly involving women in southern Benin. It plays an important socioeconomic role for women and actively contributes to the growth of the national economy. Furthermore, as evidence of its importance, farmers and processors in southern Benin assert that a farmer's wealth is measured by the size of their palm grove (Adegbola and al., 2009).

In addition to the main products of palm nut processing value chain, many by-products are obtained, such as soap, palm oil cake, and palm kernel shells. Accessing the use of these by-products also provide practical socioeconomic profitability for communities, particularly women processors. Some of them are awarded for products aroma and quality, Mono Department and its "Zomi" red palm oil, made from palm nuts is well known and highly appreciated in Benin, the Gulf of Guinea countries, and among the migrant diaspora in Europe (CIRAD-BIOS-UMR, 2012). Culturally, red oil is used to worship ancestors in Africa and in traditional ceremonies.

With regards to those advantages, promoting palm oil industry has become important both culturally and socio-economically (job creation, diversification of income sources, foreign exchange for the country, development of the agro-industrial sector, reduction of rural exodus, and diversification of women's activities) and for the conservation and regeneration of natural resources. This explains why the government has chosen it as one of the sectors to promote through its Development Planning "Programme d'Action du Gouvernement". These promotional activities cover production, marketing, and processing, with the latter involving improvements to existing refineries and soap factories. As a result, the Beninese government intends to increase the extraction rate, strengthen the industrial processing fabrics, and improve the quality of the oils.

Despite these advantages and the lack of proper organization within the sector, the palm oil processing sub-sector faces some challenges. These difficulties relate not only to its handcraft nature, but above all to the lack of financial and in-kind subsidies, particularly in the processing link. Although the study by El Arafi (2025) showed that subsidies to associations, which are supposed to encourage citizen participation, can paradoxically create financial dependence that undermines their autonomy. A solid reform of the allocation and evaluation processes is needed to make subsidies a strategic tool rather than a budgetary reflex. It is in this context that this article examines the determining

factors from the perspective of subsidy types and sources of financing in processing palm nuts into red oil in South-East Benin.

The remainder of the paper is structured as follows. The first section presents the theoretical framework that forms the basis for methodological analysis. The second section describes the study area. The third section presents the results obtained from the analysis. The fourth section provides a discussion of these results considering previous studies and the local context. Finally, the last section offers the conclusion.

## 2. Theoretical basis for methodological analysis

The theoretical basis is founded on the determinants of women's access to subsidies forms and sources of financing. Brossier and Petit's (1977) analysis of producer behavior is modeled in the literature. The approach used in analyzing the factors determining the adoption of an innovation can be estimated using a model that predicts whether an actor will adopt a given model. The decision will also depend on the socio-economic and demographic characteristics of decision-makers. A review of the literature on adoption studies reveals at least three types of models commonly used to analyze the decision to adopt an agricultural technology: the Logit, Probit, and Tobit linear probability models. The analysis of the determinants of women processors' choices or decisions to make adjustments or modifications depends on two commonly used models (Logit and Probit) (Maddison, 2007; Yegbemey and al., 2014). Logit and Probit are appropriate for analyzing adoption decisions. Indeed, the multivariate Logit model, which is a binary response regression model, is subsequently used to estimate the observed and unobserved influence of several independent variables simultaneously on the dependent variables, allowing the error terms to correlate freely. Several authors have experienced it in previous works (Piya and al., 2013; Soro, 2014; Yegbemey and al., 2014; Kanyamuka and al., 2020; Adekambi and Sohantode, 2020). Thus, in this research, such an analysis enabled a multivariate regression of the decision on access to subsidies forms for women processors.

In addition, discriminant variables were used to women groups of processors by type of agricultural subsidy using Multiple Correspondence Analysis (MCA). In the previous article, three types of agricultural subsidies were identified in the municipalities of Sakété, Ifangni, and Avrankou. These are women who use self-financing and formal financing with subsidies in kind (49.4%); women who use formal and informal sources of financing with interest and without subsidies (40.4%); and finally, women who receive subsidies in kind and interest-free loans through the ACMA project (10.2%).

Whether or not women belong to one or any other of these identified subsidy forms is tracked for further analysis. Each qualified group for subsidy forms was transformed into a binary variable taking the value 1 if the processor belongs to a group and 0 if it does not.

In this study, the multivariate Logit model was chosen. This model has also been used by several authors in previous studies (Piya et al., 2013 ; Soro, 2014 ; Yegbemey and al., 2014; Kanyamuka and al., 2020; Adekambi and Sohantode, 2020). According to Adekambi Sohantode, (2020), the processor could choose a given subsidy type as

accordingly to the expected usefulness goal represented by $\boldsymbol{U_1^*}\ (\pi)$ is greater than that which it would derive if it had not chosen it, represented by $\boldsymbol{U_0^*}\ (\pi)$, or $\boldsymbol{U_1^*}\ (\pi) > \boldsymbol{U_0^*}\ (\pi)$. The utility to maximize $(\boldsymbol{U_i^*})$ and on which the decision of women processors adopting an agricultural subsidy or not which basis is not observable but generally depends on a set of socioeconomic, demographic, and institutional factors $(\boldsymbol{Q_i^*})$ and can therefore be represented by the latent variable as follows:

$$\boldsymbol{U_i^*} = \boldsymbol{Q_i^*}\beta + \varphi \mathrm{i}\,, \mathrm{i} = 1{,}2 \ldots \ldots \mathrm{N} \qquad (1)$$

With β the vector of parameters to be estimated and the random disturbance.

Joint adoptions for the three forms of subsidies can be modeled by a system of three dichotomous equations $Zi$ as follows:

$$Z1 = 1\ si\ U_1^* > U_0^*\ ; Z1 = 0\ \ si\ autrement$$
$$Z2 = 1\ si\ U_2^* > U_0^*\ ; Z2 = 0\ \ si\ autrement$$
$$Z3 = 1\ si\ U_3^* > U_0^*\ ; Z3 = 0\ \ si\ autrement$$

Empirically, the model estimated with the variable included in the estimates is as follows:

$$SBV = a_0 + a_1\mathrm{NIVEAU}_i + a_2\mathrm{SYSTW}_i + a_3\mathrm{FORTECH}_i + a_4\mathrm{GROUP}_i + a_5\mathrm{CONTACT}_i + a_6\mathrm{AGE}_i + a_6\mathrm{NBRACT}_i + \omega_i$$

The dependent variable in the above equation is a dichotomous variable which takes the value 1 if processor i belongs to the subsidy forms j (with j = Self-financing and formal financing with in-kind subsidies (AU_TFIN_SVN); Formal and informal financing with interest rates without subsidies (FIN_FORM) and In-kind subsidies and interest-free loans (SVN_SVF), and 0 if not.

The socioeconomic characteristics of women and processing techniques introduced into the model are summarized in the following table:

**Table 1: Description of explanatory variables introduced into the models**

| Variables | Effects of variables | Authors | Signs |
|---|---|---|---|
| Secondary education level (LEVEL OF INSTRUCTION) | The level of education increases the ability of the actor (processor) to make decisions after analyzing the information available. | (Adékambi *and al.*, 2020) | + |
| Warrantage system (SYSTW) | This involves granting or extending credit by allowing farmers to store their products—or part of them—in a secure storage facility after harvest. The stored harvest serves as collateral for a loan, as the owners no longer have free access to what is stored. Warrantage allows | (Bliss, 2024)<br><br>(Yai *and al.*, 2022) | + |

| Variables | Effects of variables | Authors | Signs |
|---|---|---|---|
| | warrantors to have multiple sources of income and ensures the supply of products in the community. It thus ensures food security in the community and prevents the skyrocketing prices of warrant products | | |
| Technical training in processing (FORTECH) | Training for producers has a positive impact on access to agricultural credit. Producers who have received training in production techniques will have a greater need for financing in order to pay for the important factors of production to implement the techniques learned during the training. | (Ololade and Olagunju 2013). | + |
| Membership in a group (GROUP) | Membership in a group has a positive impact on producers' access to agricultural credit. Producers who belong to an organization find it easier to obtain agricultural credit, as loans are granted to producers in groups for joint guarantees to ensure the effective repayment of borrowed funds and limit the risk of insolvency. | (Gbinlo and Soglo 2003 ; Awo *and al.*, 2021). | – /+ |
| Contact with an extension agent (CONTACT) | Direct contact with the facilitator and/or technician facilitated access to credit, as exerting professional responsibilities alongside producers increased the likelihood of adopting a source of financing by facilitating exchanges, access to information and communication, and coordination. | (Gbinlo and Soglo 2003 ; Louis and Rousset, 2010). | + |
| The age of processors (AGE) | Age has a positive impact on access to agricultural credit. The older producers are or the more experience they have, the more they use agricultural credit for various processing operations. Age is therefore often used as an indicator of maturity in decision-making processes. | (Mohamed 2003). | + |

**Source:** *Literature reviews of authors*

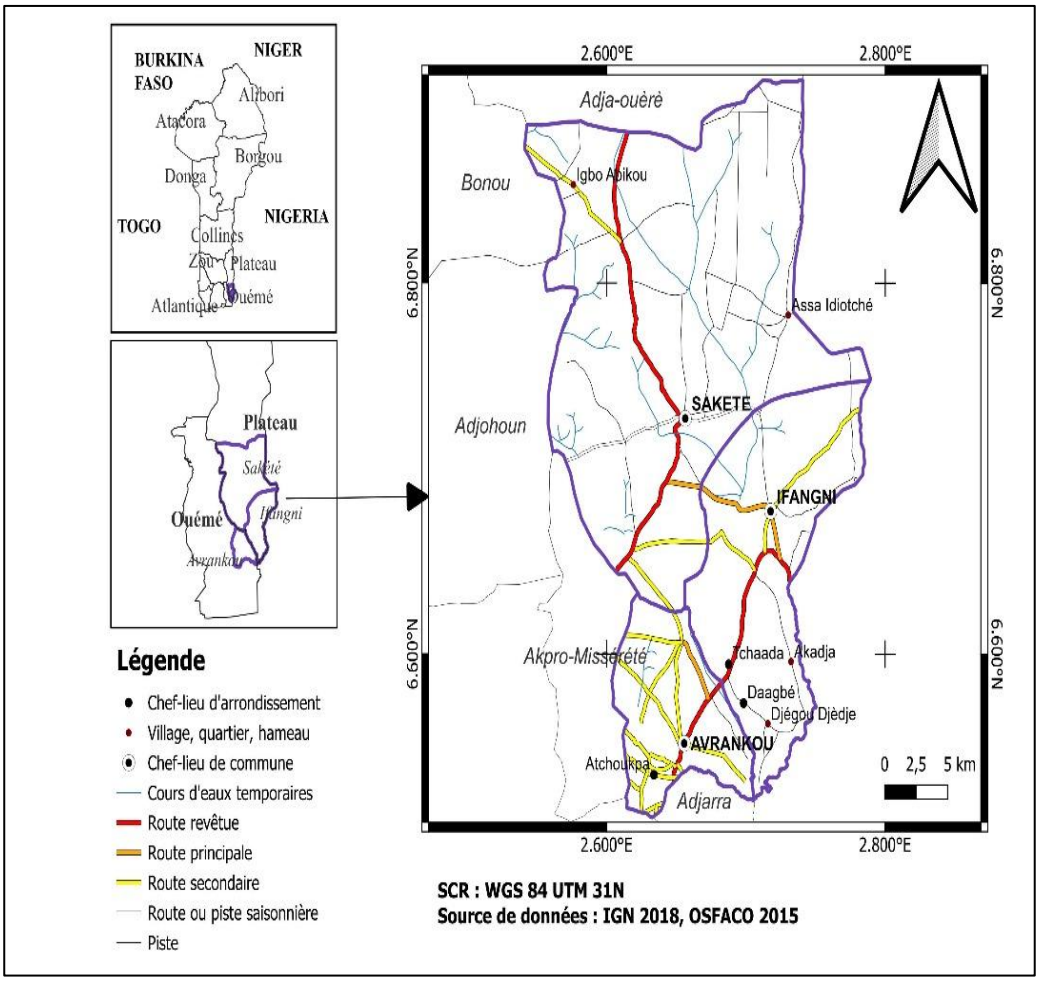
## 3. Study area

This study was conducted in the Plateau and Ouémé Departments in southeastern Benin. These departments were chosen because Agri cluster N° 6 considers palm oil to be a flagship crop and Agri cluster N° 7 considers it to be a secondary crop (MAEP, 2023). In each of these departments, three municipalities were selected: Sakété and Ifangni in the Plateau department and Avrankou in the Ouémé department.

Located in southeastern Benin, the municipality of Sakété lies between 6°36'20'' and 6°55'34'' north latitude and 2°33'24''and 2°47'31'' east longitude (Oguidi and al., 2023). The municipality of Sakété is bordered to the north by the municipality of Adja-Ouèrè, to the southwest by the municipality of Adjohoun, to the southeast by the municipality of Ifangni, to the east by the Federal Republic of Nigeria, and to the west by the department of Zou (Oguidi et al., 2023). Avrankou is bordered to the north by the municipality of Sakété, to the south by the municipalities of Adjarra, Porto Novo, and the Federal Republic of Nigeria, to the east by the municipality of Ifangni, and to the west by the municipality of Akpro Missérété (Hessou and al., 2024). It lies between 6°31'01' and 6°38'06' north latitude and between 2°36'41''and 2°42'27'' east longitude (Agbon and al., 2021). Finally, the municipality of Ifangni is bordered to the south by the municipality of Adjarra, to the west by the municipalities of Avrankou and Sakété, to the north by the municipality of Sakété, and to the east by Nigeria (Houssou, 2024).

Furthermore, sampling was carried out in two stages: First, simple random sampling was used to select the villages and processors. Next, snowball sampling was used to collect data from 312 palm nut processors in the area, with 104 processors per municipality.

**Figure 1: Map of the study area**




*Source: Authors, 2025*

## 4. Results

### 4.1 Age and number of years of experience in palm nut processing

Table II below shows the age of the processors and their experience in palm nut processing. Analysis of the results in this table reveals that the study population is relatively young, with an average of approximately 42 years (±8.887) and an average of 15 years (±8.910) of experience in processing palm nuts into palm oil.

The breakdown by municipality indicates that the average age of women processors in the three municipalities is indeed around 42 years (±8.887), with specific values of 41 years (±7.910) in Avrankou, 42 years (±9.472) in Ifangni, and 42 years (±9.253) in Sakété. On the other hand, the distribution of years of experience as per municipality reveals that the processors in Avrankou, with an average of 13 years (±6.554), are the

least experienced, followed by those in Sakété with an average of 14 years (±9.329). The processors in Ifangni are the most experienced, with an average of 17 years (±10.043) of experience. Thus, it appears that among the three municipalities, the processors in Avrankou are the youngest in terms of "age and experience".

**Table 2: Age and number of years of experience in palm nut processing**

| Variables | Commune | | | Total |
|---|---|---|---|---|
| | Avrankou | Ifangni | Sakété | |
| Age of the processor | 41,24 (±7,910) | 42,26 (±9,472) | 41,91 (±9,253) | 41,80 (±8,887) |
| Experience in palm nut processing | 12,96 (± 6,554) | 17,03 (±10,043) | 14,11 (±9,329) | 14,70 (±8,910) |

*Source : Survey data, 2024*

**4.2 Marital status of women who process palm nuts into oil**

Table III below shows the distribution of respondents according to their marital status. It reveals that, in the three municipalities in investigation, the majority of female processors surveyed are married: 90.4% in the municipality of Avrankou, 81.7% in Ifangni, and 98.1% in Sakété. Widows are very poorly represented, while single and divorced women make up a very small proportion. These results could be explained by the fact that palm nut processing is a complex activity requiring a large workforce, often provided by family members, which helps to reduce production costs. In addition, the average age of women processors, which is 31, generally corresponds to the age at which many people get married in rural areas.

**Table 3: Distribution (%) of surveyed women processors according to marital status**

| Marital status of the respondent in % | Communes | | |
|---|---|---|---|
| | Avrankou | Ifangni | Sakété |
| Single | 1.9 | 0.0 | 0.0 |
| Divorced | 2.9 | 1.0 | 0.0 |
| Married | 90.4 | 81.7 | 98.1 |
| Widow | 4.8 | 17.3 | 1.9 |

*Source : Survey data, 2024*

**4.3 Main activity of women palm nuts processor into oil**

Table IV shows the distribution of the surveyed women processors according to their main activity. A detailed analysis of the data shows that palm nut processing is the main activity for most women processors in the three study municipalities. In fact, 78.8% in Avrankou, 97.1% in Ifangni, and 100% in Sakété are mainly engaged in such activity. This means that only 21.2%, 2.9%, and 0% of women processors in these respective municipalities have palm nut processing as a secondary activity. It should be noted that these women processors' main activities are agriculture, trade, and crafts.

**Table 4: Distribution (%) of women processors surveyed according to their main activity**

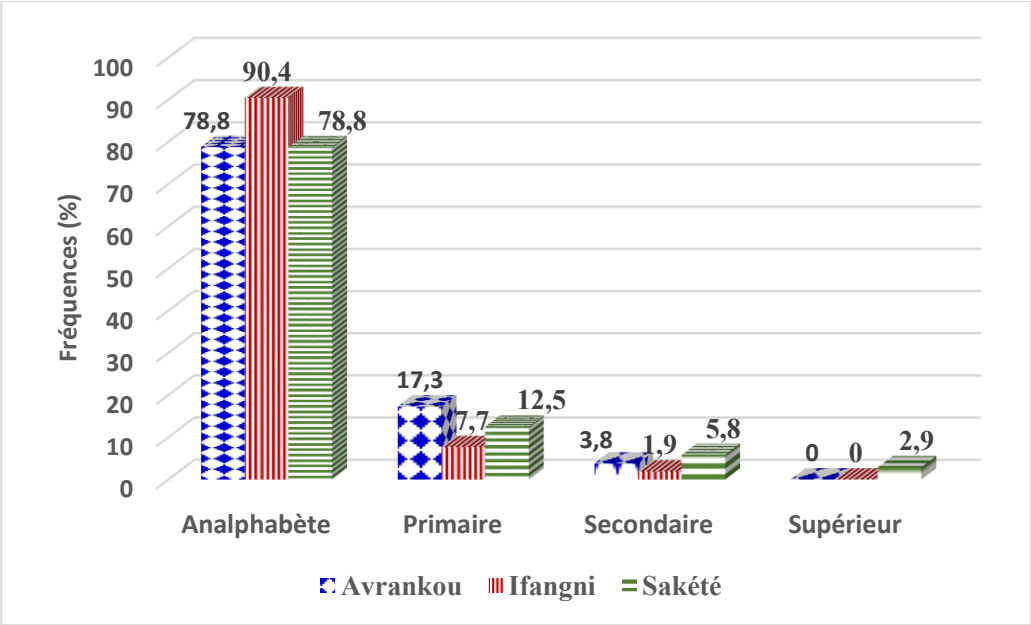
| Main activity in % | Communes | | |
|---|---|---|---|
| | Avrankou | Ifangni | Sakété |
| Farmer | 15.4 | 0.0 | 0.0 |
| Craftsmanship | 3.8 | 1.0 | 0.0 |
| Trade | 1.9 | 0.0 | 0.0 |
| Service | 0.0 | 1.9 | 0.0 |
| Processing of palm nuts | 78.8 | 97.1 | 100.0 |

*Source : Survey result 2024*

✓ **Educational level of respondents**

Figure 2 above illustrates the educational level of female processors. According to the results, 78.8%, 90.4%, and 78.8% of female processors surveyed are uneducated in the municipalities of Avrankou, Ifangni, and Sakété, respectively. In contrast, 17.3%, 7.7%, and 12.5% had completed primary school education, and 3.8%, 1.9%, and 5.8% had completed secondary school education in these three municipalities, respectively. The same results show that only about 3% of the most educated (University level) palm nut processors surveyed were located in the municipality of Sakété. It can be understood that the number of processors decreases as the level of education increases, which could be explained by the fact that palm nut processing is a very time-consuming activity and does not require a high level of education.

**Figure 2 : Distribution (%) of processors as per level of education**




*Source : Survey data, 2024*

✓ **Membership in a group and contact with extension services**

Table V shows that 47.1% belong to a women processors' group and 16.3% are in contact with extension services or development projects/programs in the study area. In regards to each municipality as individual, it was demonstrated that 39.4% and 59.6% belong to a women palm nut processors' group in the municipalities of Avrankou, Ifangni, and Sakété, respectively. However, a minority of 42.3% belong to a women palm nut processors' group in the municipality of Avrankou. 42.3% and 59.6% belong to a palm nut processing group in the municipalities of Avrankou, Ifangni and Sakété, respectively. However, a minority of 10.6%, 7.7% and 30.8% have contact with extension services or projects/programs in the study area. It can be concluded that, among the women processors who belong to the group, very few participate to the meeting or at least they are not monitored or technically supported in their activity.

**Table 5: Distribution in (%) of the surveyed women processors**

| Parameters | Modalities | Communes | | | |
|---|---|---|---|---|---|
| | | Avrankou | Ifangni | Sakété | Total |
| Membership in a group of processors | **Yes** | **39.4** | **42.3** | **59.6** | **47.1** |
| | No | 60.6 | 57.7 | 40.4 | 52.9 |
| Contact with Project/Program or extension services | **Yes** | **10.6** | **7.7** | **30.8** | **16.3** |
| | No | 89.4 | 92.3 | 69.2 | 83.7 |

*Source : Survey data, 2024*

### 4.4 Determinants of subsidy types and funding sources

To identify the determinants of financial and/or in-kind subsidies in palm nut processing, a multivariate Probit regression model was estimated. The results have shown that the model is globally significant at the 1% threshold (P-value < 0.000). Good prediction percentages are calculated by referring to the probabilities predicted by the model and the observed probabilities. The diversifications in the explanatory variables introduced into the model explain 0.15%, 0.16%, and 0.164% of the variations observed in self-financing and formal financing with subsidies in kind; formal and informal financing with interest without subsidies; and subsidies in kind and interest-free loans, respectively. The constants of the estimated regression models are also statistically significant at the 1% threshold (Table V). In general, the factors determining the various forms of financial and/or in-kind subsidies in palm nut processing are: technical training in oil processing, membership of a group, contact with an extension worker, marital status, and experience in oil processing.

✓ **Membership in a group**

Membership in a women processors' group has a positive and significant impact on *self-financing and formal financing with subsidies in kind* followed by *subsidies in kind and interest-free loans* respectively, at statistical thresholds of 1%. Indeed, membership in

an organization is one of the medium- and long-term strategies widely used to benefit from subsidies through projects/programs or to easily access formal credit when facing financial difficulties or a lack of self-financing.

✓ **Contact with an extension agent**

Contact with an extension service has a significant negative impact on the use of in-kind subsidies and interest-free loans by women processors at the 1% statistical threshold. On the other hand, contact with an extension agent has a significant positive effect on women processors' use of formal and informal sources of financing with interest and without subsidies at the 5% statistical threshold. An extension agent's relationship with women processors increases the likelihood of access to formal credit in the areas, but not of receiving subsidies in kind or in cash.

✓ **Use of semi-mechanized units**

The system for processing palm nuts into red oil has a positive and significant effect on the use of self-financing and formal financing with subsidies in kind, as well as subsidies in kind and interest-free loans, at statistical thresholds of 10% and 1% respectively. On the other hand, the use of semi-mechanized units is negatively and significantly influenced by the use of formal and informal sources of financing with interest and without subsidies. Indeed, when processors do not have access to financial or in-kind subsidies, they have difficulty paying for processing equipment or materials after paying off loans from decentralized financial services (SFD).

✓ **Warrantage system**

The warrantage system used by processors has a significant impact on the various forms of subsidies. When processors receive mixed subsidies (subsidies in kind and interest-free loans) the probability that they will use the warrantage system in palm nut processing increases at the 1% statistical threshold and decreases at the 10% threshold for the use of formal and informal financing with interest without subsidies.

✓ **Marital status**

The marital status of women processors has a significant impact on the various forms of subsidies. When a woman processor is married, this has a positive and significant effect on her use of formal and informal sources of financing with interest, without subsidies at the 10% threshold. Furthermore, the widow status of women processors has a positive effect on their use of in-kind subsidies and interest-free loans for their activities at the 5% threshold. Being a widow in fine ultimately appears to be one of the determining factors in access to financial and in-kind subsidies, if we consider being married as the "reference" situation.

✓ **Number of assets in processing**

According to the literature, household size and the number of people working in agriculture are very important factors in terms of agricultural producers' access to credit. Considering the agricultural worker factor within the household, the number of women in the household is positively and significantly correlated with formal and informal sources of financing with interest and without subsidies at the 10% statistical threshold,

**Table 6: Results of the multivariate probit mode**

| Explanatory variables | Self-financing and formal financing with in-kind subsidies | | Formal and informal financing with interest without subsidies | | Grants in kind and interest-free loans | |
|---|---|---|---|---|---|---|
| | Coef | P>\| Z \| | Coef | P>\| Z \| | Coef | P>\| Z \| |
| Stability | 1.546*** | 0.004 | 0.473 | 0.366 | -1.020*** | 0.002 |
| Number of assets in processing | 0.326 | 0.524 | 0.236*** | 0.004 | 0.089 | 0.217 |
| Warrantage system | 0.163 | 0.613 | -0.391* | 0.063 | 0.228*** | 0.000 |
| Contact with an extension agent | 0.041 | 0.613 | 0.085** | 0.038 | -0.0443*** | 0.001 |
| Membership in a group | 0.010*** | 0.001 | -0.199 | 0.862 | 0.189*** | 0.000 |
| Marital status (Married) | 0.100 | 0.615 | 0.183* | 0.055 | -0.083 | 0.485 |
| Marital status (Widowed) | -0.297 | 0.147 | 0.302 | 0.130 | 0.005** | 0.030 |
| Level of secondary education | 0.571 | 0.141 | -0.360 | 0.185 | -0.210 | 0.208 |
| Use of handcraft units | -0.657 | 0.165 | 0.375 | 0.614 | 1.032 | 0.417 |
| Use of semi-mechanized units | 0.820* | 0.096 | -0.242*** | 0.000 | 1.063*** | 0.000 |
| Experience in processing | 0.002 | 0.539 | -0.002 | 0.432 | 0.000 | 0.798 |
| Summary of the model | R= 0.470 $R^2$= 0.149 | | R= 0.459 $R^2$= 0.157 | | R= 0.282 $R^2$= 0.164 | |
| | F= 4.793 P= 0.000 | | F= 5.089 P= 0.000 | | F= 5.373 P= 0.000 | |

*Source: Regression by authors*

which shows the importance of this variable in credit demand among agricultural households. In fact, households with enough dependents, particularly female workers, tend to take out loans from several microfinance institutions in addition to self-financing in order to meet the needs of their activities. The probability of these households accessing banking financial services, especially in several microfinance institutions, is very high in order to guarantee their financial security due to a lack of subsidies.

## 5. Discussion

In many African countries, the palm oil sector has significant economic importance. In Nigeria, the palm oil industry employs millions of workers, while it is a major source of income for women in southeastern Benin. Small-scale palm oil processing is mainly carried out by women, working either in groups or individually. According to Ofosu-Budu and Sarpong (2013), women are mainly employed in the processing and marketing palm oil, the sale of palm fruits, and the processing and marketing of palm fruit kernels.

Furthermore, Zakariyaou and Abdoul (2022) showed that public funding through direct subsidies has a positive and significant impact on GDP growth and per capita GDP growth. Unfortunately, subsidies in the form of financing and equipment/materials are not fully guaranteed to support women who process palm nuts into red oil in southeastern Benin. The results of this study reveal that membership in a group and the processing system encourage the use of self-financing and formal financing with subsidies in kind. Furthermore, mixed subsidies (subsidies in kind and interest-free loans) are positively influenced by the processing system used, the practice of the warrantage system, membership of a group, and widowhood status. On the other hand, women's use of formal and informal financing with interest and without subsidies is strongly correlated with contacting an extension service and the number of active women in the household.

When women belong to a processing association, they benefit from technical training in their activities, information on market prices for products, and they are informed about opportunities for processing. The training program of groups is important in order to promote communication, develop activities with parallel to processing, and build social solidarity around their activities and networks (Ofosu-Budu and Sarpong, 2013). In addition, women who belong to an organization are often spared the problems of adverse selection, moral hazard, and information asymmetry.

Government-led agricultural subsidies will improve traditional palm oil processing methods (Mukwama and al., 2024) and encourage the adoption of financial management practices by these producers (Rege and Lee, 2022). Such subsidies will also enable women to increase productivity in order to meet higher demand from exporters and improve their income from processing activities. Consequently, value chain financing by public banks and government subsidies are important means of supporting women processors (Founanou, 2021). However, very few women processors (around 26%) have access to financial services and subsidies in production environments. Although subsidies to associations, which are supposed to promote citizen participation, can paradoxically create financial dependence that undermines their autonomy (EL ARAFI, 2025). One of the strategies to overcome this financial dependence must consider the factors determining subsidies identified in this survey.

## 5. Conclusion

Financial and in-kind subsidies, which must go far beyond simple economic support, play a decisive role in the social reintegration of women who process palm nuts into red oil in southeastern Benin. The results of this research show that the future of palm oil production in southeastern Benin depends on Government support for women in the form of financial and in-kind subsidies. To benefit from these subsidies, women must meet conditionalities or develop certain characteristics related to factors such as: membership in a group, the practice of warrantage, contacts with extension services, and the availability of women's assets for processing to enable the community, through projects/programs, to fully ensure their roles in the palm nut processing chain in southeastern Benin.

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