Journal of Agriculture and Rural Development in the Tropics and Subtropics
Vol. 126 No. 1 (2025) 85–96

https://doi.org/10.17170/kobra-2025011410821 ISSN: 2363-6033 (online); 1612-9830 (print) – website: www.jarts.info

Determinants of poverty in the cassava stick sector in the Haut Ogooué province in southeastern Gabon

Ranaud Allogo Abessolo [a,b,*], Ingrid Lithia Ekanatsaga [b], Christian Moupela [b], Fabio Berti [a], Philippe Burny [a], Philippe Lebailly [a]

[a] *Laboratory of Economics and Rural Development, Gembloux Agro-Bio Tech, University of Liège, Belgium*

[b] *Département Agroéconomie, Institut National Supérieur d'Agronomie et Biotechnologies (INSAB) / Université des Sciences et Techniques de Masuku (USTM), Gabon*

Abstract

To escape poverty, Gabonese rural populations have moved overwhelmingly to the country's cities. Due to a lack of skills for better jobs, they are mostly engaged in informal activities, particularly in the agri-food sector. This study focuses on the poverty of direct actors in the cassava stick sector (CSS) in the province of Haut Ogooué (HO) in southeastern Gabon. The sample consists of 30 farmers, 157 cassava stick producers, 33 mill managers and 3 cassava paste importers. The socio-demographic, economic and poverty probability index (PPI) characteristics of these individuals were reported. Using a multivariate linear regression model with the PPI score as the dependent variable, the determinants of poverty were sought. The results show that women (90 %) dominate this sector, almost a third of whom are heads of household. These actors are relatively old, poorly educated and the majority have less than 15 years of professional experience. Revenues from the activities of the CSS are used only to meet daily needs (76 %). With an average PPI score of 51.9, the linked reference table indicates that 33.7 % of farmers live below the poverty line. Importers of cassava pastes are less affected (2.2 %). Finally, the money earned by most actors is insufficient. According to the model, it is the activity that the person does or does not perform outside this sector that determines whether this actor lives below the poverty line ($p < 0.05$).

Keywords: *Manihot esculenta*, local food, urban poverty, women, sub-Saharan Africa

1 Introduction

Family farming has long been the main source of food and employment for the Gabonese people. Despite the fact that 90 % of the them now live in cities, the agricultural sector still employs about one in five people (RGA, 2020). These farmers are affected by poverty, whether in rural or urban areas. The extent of poverty, estimated at 33 % in Gabon, is paradoxical given the country's wealth, including oil, manganese and timber (UNICEF, 2022). Moreover, its population is only 2.3 million people. As a result, it is classified as a high human development country. Cassava (*Manihot esculenta*) is the most important food crop in Gabon, accounting for almost 60 % of the area used for subsistence agriculture. On average, each inhabitant of the country consumes around 158 kg of cassava per year (FAO, 2023; RGA, 2020). In 2021, Gabon's cassava production was estimated at 312,300 tons compared to 130,000 tons in 1961, an increase of 140 % in 60 years. However, the country has a deficit in this commodity because, during the same period, the total population increased by 304 % (FAOSTAT, 2024; World Perspectives, 2024). In Gabon, the production and processing of cassava is exclusively artisanal and focused on a flagship product which is the cassava stick. This presentation of fermented cassava pastes stewed and wrapped in *Marantaceae* leaves is called *chikwangue* in both Congo and Bobolo in Cameroon (Atta Doha & Sogan, 2018; RGA, 2020). In Gabon, each region or ethnic group has its cassava stick, some like the *Téké* cassava sticks are appreciated and consumed beyond their region of origin. They are then marketed at the national and/or sub-regional level. Among the factors that determine the extent of this trade are the perishability of the product and the

* Corresponding author – simondaniel19@gmail.com

Published online: 24 March 2025 – Received: 14 Dcember 2023 – Accepted: 6 January 2025

ability of each country to feed its growing urban population. For instance, Gabon imports cassava sticks from Cameroon, mainly to Libreville. On the other hand, Gabonese cities near the Republic of Congo import cassava pastes, that are processed into sticks in Gabon (AGASA, 2020; Madoungou, 2022; Chekote *et al*., 2020).

Developing countries, including Gabon, face several challenges, including reducing the poverty of direct actors in agri-food sector, especially those involving local products. This is because these sectors have been neglected by public authorities and, in urban areas, suffer from the westernisation of eating habits (Teyssier *et al*., 2019). Furthermore, the marketing of local processed foods is less integrated into formal urban marketing circuits and employs the most disadvantaged populations, especially young people and women. (Diwakar & Shepherd, 2022; Donkor *et al*., 2022; Hammond *et al*., 2023).

It is difficult to find a definition of poverty that is universally accepted and reflects its multidimensional nature. Nevertheless, the authors agree that poverty is marked by no or poor access to income, material goods, good health or education. It can be a relative deprivation of all these aspects at the same time. The literature also agrees on a graduation of poverty. This makes it possible to speak of extreme poverty, general or human poverty (Benicourt, 2001). According to United Nations Development Program (UNDP), a person lives in poverty if he or she does not have sufficient income to meet his or her basic and non-food needs such as clothing, energy, shelter and health (Benicourt, 2001). Poverty in monetary terms is easier to define because it sets income thresholds. In a lower-middle-income country, according to the World Bank, a person with an income of less than USD 3.20 per day is considered to be living in extreme poverty (Jobarteh, 2024; World Bank, 2024). Gabon is classified as an upper middle income country (Jobarteh, 2024). For countries in this position, the World Bank considers people living below the poverty line to have an income of less than USD 5.5 per day (Jobarteh, 2024; World Bank, 2024). The poverty of actors in agricultural value chains is linked to gender inequalities, living conditions, actors' social capital and their ability to generate income outside of agriculture (Diwakar & Shepherd, 2022; Manganyi *et al*., 2023; Zakaria *et al*., 2022). The local and national context is therefore central to addressing poverty in the agricultural sector, and detailed knowledge of it is a prerequisite for any intervention.

This work focuses on the poverty of the only direct actors of the CSS in the province of Haut Ogooué (HO) in south-eastern Gabon. It assesses the proportion of people working in this sector who live below the daily poverty line of USD 5.5 in Gabon in 2023 (Jobarteh, 2024). The research question is: What proportion of direct actors in CSS in the HO live below the poverty line and what are the determinants?

The main objective of this work is to strengthen existing knowledge on the impact of the socio-economic and social context on the poverty of small-scale agri-food actors in developing countries. More specifically, it aims to:

- Describe the socio-demographic profile of the direct CSS actors in the Haut Ogooué.
- Determine the intensity of poverty according to the activities conducted and the type of actor.
- To identify the determinants of the phenomenon of poverty in this sector.

2 Materials and methods

2.1 Study area

Fig. 1 shows the location of the study area on the map of Gabon and the map of the HO province.

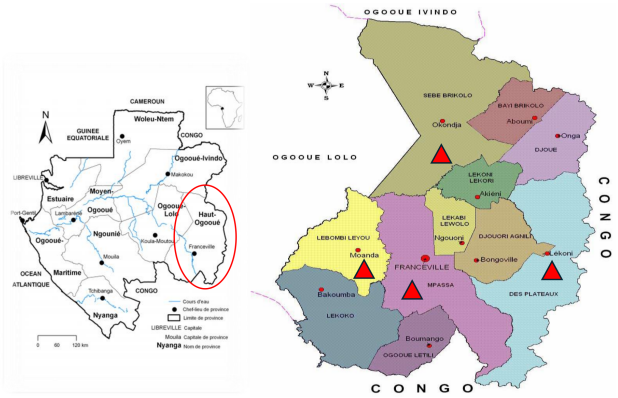


Fig. 1: *Location of Haut Ogooué province on the map of Gabon and the towns where the data were collected on the map of Haut Ogooué department. Source: Laboratoire National de cartographie (1983).*

This study was conducted in the province of HO, located in the south-east of Gabon and bordering the Republic of Congo. There are several reasons for choosing this area, the first being its proximity to Congo. This geographical location is a source of mobility for goods and people. These exchanges are reinforced by the cultural proximity of the inhabitants of this region of Central Africa (Wali Wali & Makita-Ikouaya, 2022). The second reason is that the province of HO is the area of origin of the *Téké* Cassava Stick. A typical food product that is extremely popular locally and throughout the country. The final reason for choosing this province is that it is home to the only university in

Gabon that teaches and conducts research in agricultural sciences. It is also an important economic centre; manganese ore and timber have been exploited in this part of Gabon for several decades.

Gabon is an underpopulated country, with an average density of five inhabitants/km², this value is even less than one in several localities within the country (RGPHL, 2015). Data collection was conducted in and around the main towns of the departments of Passa (Franceville), Lébombi-Léyou (Moanda), Sébé-Brikolo (Okondja) and Des Plateaux (Léconi). This province, which has 11 departments, is located just over 600 km from the capital Libreville, the largest city in Gabon. The four departments selected for this work are the most populous. They are home to more than 85 % of the province population, led by the cities of Franceville and Moanda (RGPHL, 2015). These four locations can be classified into two groups with slight variations within them. The cities of Franceville and Moanda form the first group and are the largest cities in the province. In Gabon, these are medium-sized cities that are less economically dynamic than Libreville. In 2013, the department of Passa, of which Franceville is the nerve centre, had about 130,000 inhabitants and Lébombi-Léyou 65,000. The economy of these localities is dominated by industrial manganese mining, urban services and public administration (RGPHL, 2015). The second group is made up of secondary cities at the provincial level, at the national level they are considered as rural agglomerations, especially Léconi. In 2013, the total population of the departments of Sébé Brikolo and Des Plateaux was about 24,500 inhabitants. The economy is predominantly agricultural, with some logging and spring water activities that provide few formal jobs (RGPHL, 2015). The economy of the city of Okondja is slightly more dynamic than that of Léconi, thanks to the recent development of a manganese mine (Lepengué *et al*., 2019).

2.2 Poverty probability index

The poverty probability index (PPI) is a tool for assessing poverty. It is used by organisations or projects with limited resources and time. The PPI is both statistically sound and simple to use in practice. The probability of living below the poverty line in a household to which an individual belongs is calculated based on the answers to 10 questions. These questions, proposed by the Innovations for Poverty Action (IPA), are the same for all countries and years. They relate to the characteristics of the respondent's household, those of the head of household, and the ownership of assets. However, there may be slight differences in the questions asked from one country to another depending on the level of poverty of the country surveyed. These differences concern certain assets that are considered elementary or a sign of wealth in the study area. The other source of difference is the way in which the various response options are evaluated. This is left to the discretion of the enumerators, who assign points to each question according to their knowledge of the study area. The PPI allows enumerators to identify targets (households, individuals) who are more likely to be poor or vulnerable to poverty. It measures multidimensional poverty by a score between 0 and 100 (IPA, 2023). A respondent's household is less poor if its score is close to 100. For a group, with an average PPI score is used to determine the proportion of people living below the poverty line. This average is compared with a reference frame. The ten questions used to calculate the PPI score, and the points assigned to each answer are presented in Table 1. These questions focus on three aspects: place of residence, level of education, and ownership of assets. These factors were selected because they are markers of poverty and/or social exclusion in Gabon and elsewhere (IPA, 2023). Gabon is a highly centralised country in which access to employment depends largely on the level of education and the distance from the capital, Libreville (Pottier *et al*., 2017).

To determine the proportion of individuals living in poverty, among the constituted groups, the average PPI score calculated is compared with a reference table. In this study, the reference table used was that of South Africa. This country was chosen because a large-scale survey using the PPI was conducted there in 2019. This is not the case for Gabon. In addition, South Africa is the only upper-middle-income country in Africa that has this benchmark. In addition to being both upper-middle-income countries, Gabon and South Africa have the same Human Development Index (HDI) of 0.7 (UNDP, 2022).

2.3 Cassava production and availability in Gabon

The Fig. 2 present the mean cassava roots production and availability for each inhabitant of Gabon since 1961. It shows that from 1961 to 2022, cassava root production in Gabon has indeed increased, but at a slower rate than the population. During this period, cassava root production increased by 140 %, while the population increased by 304 %. De facto, the availability of cassava roots per person has continued to decline. This started around 1979, the period of the first global oil shock, because this rentier economy country has recorded massive inflows of money. This has led to a spectacular increase in the urban population. These new urban dwellers have come to work on the many projects that have been launched (Wunder, 2003). The other side of the coin is that cassava fields have been abandoned and family

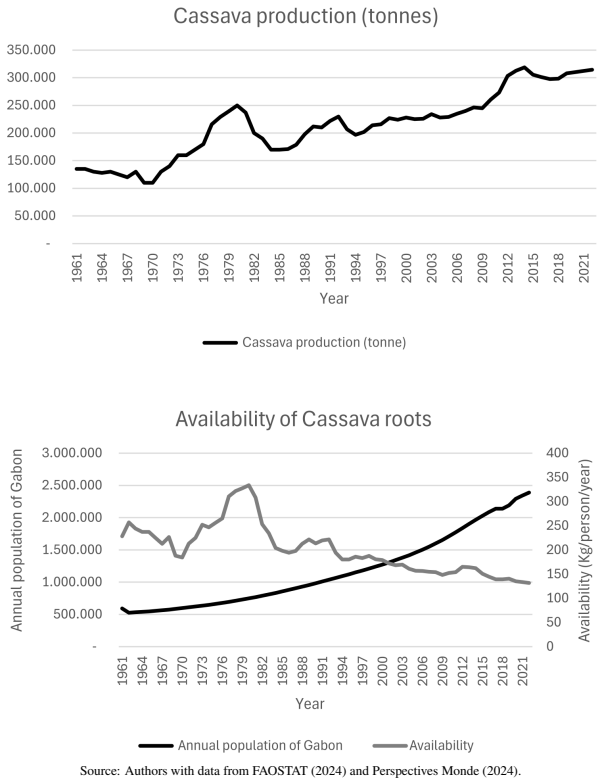
Table 1: *The ten questions and their scoring for the determination of the PPI score.*

No.	*Question*		*Answer option*	*Points*
1	In which department does the household reside?	A	Passa (Franceville)	20
		B	Lébombi-Léyou (Moanda)	20
		C	Sébé-Brikolo (Okondja)	10
		D	Des Plateaux (Léconi)	5
2	How many members does the household have?	A	Three or less	4
		B	Four or more	2
3	What is the highest level of education attained by the head of the household?	A	None	0
		B	Primary	0
		C	Secondary	10
		D	Academic	25
4	Did all children between the ages of 6 and 16 attend school regularly this school year?	A	HH has no children between 6 and 16 years old	0
		B	All children attended school this year	15
		C	At least one child did not attend school this year	4
5	What water supply is available?	A	Tap water in the house	8
		B	Tap water in the courtyard	6
		C	Tap water outside	4
		D	Well in the courtyard	0
		E	Public well	0
		F	Village pump	0
		G	Surface water (backwater, river) or other water	0
6	What type of toilet is available?	A	Toilet inside	6
		B	Outdoor toilet	2
		C	Latrines in the courtyard	0
		D	Extra-courtyard latrines	0
		E	On the street, no toilet or anything else	0
7	Where do you shower?	A	Outside	0
		B	Rudimentary shower	1
		C	Bathroom	4
		D	Other	0
8	Does the household own a motorcycle, car or van that has been in good working order in the last 3 months?	A	The household owns a car or van	14
		B	The household owns a motorcycle and does not own a car or van	6
		C	None	4
9	Does the household have a fan that has been in good working order for the last 3 months?	A	Yes	2
		B	No	0
10	Does the household have a bed that has been in good working order in the last 3 months?	A	Yes	2
		B	No	0
	Maximum total			100
	Minimum total			11

farming in general has been neglected by the relevant authorities (Pourtier, 1980).

2.4 Sampling and data collection

This study implemented a sampling method combining multi-stage random selection and the snowball technique to select respondents (Donkor *et al*., 2022; Neema Ciza *et al*., 2022). Thus, out of the 30 farmers surveyed, at least 5 were selected per locality. Some of the farmers were presented to the investigators by agents of the Ministry of Agriculture. The others were directly approached by investigators who asked for their consent. Then, randomly and with the concern of covering the sub-areas of the localities, the sample of farmers was established. As for the importers of cassava pastes, they were identified thanks to mill managers and cassava sticks producers. By triangulation of the information given by these actors, only three people were identified as importing cassava pastes from Congo Brazzaville. The 33 cassava mill managers were selected as the farmers but with the help of the cassava stick producers. Investigators



Source: Authors with data from FAOSTAT (2024) and Perspectives Monde (2024).

Fig. 2: *Annual cassava root production and availability per inhabitant in Gabon from 1961 to 2022.*

asked where they crush their cassava pastes. Finally, regarding the 157 producers of cassava sticks, the two interviewers directly visited the neighbourhoods of each town. The cassava sticks producers were approached at the points of sale of their production. Those who agreed to participate in the study were selected. Nevertheless, in a market with several female cassava sticks producers, the choice was random. Finally, the distribution of the interviewees according to the four departments is as follows: 112 in Passa (Franceville), 47 in Lébombi-Léyou (Moanda), 31 in Des Plateaux (Léconi), and 33 in Sébé-Brikolo (Okondja). The sample constituted is representative of the cassava sector in terms of the diversity of activities, locations, production and working methods, as well as the socio-demographic and economic profiles of the direct actors. However, it is not numerically representative of farmers and producers of cassava sticks.

The data was collected in a single round, using a semi-structured questionnaire administered face-to-face between March and September 2023. The interviews provided information on the socio-demographic variables of the actors, the technical and commercial requirements of their activities, the use of income and participation in savings and loan groups (SLGs). Finally, for all actors, the PPI score was determined using the same questions and the poverty rate according to the same frame of reference.

2.5 Description of variables retained and underlying assumptions

The explanatory variables of the multivariate linear regression model were chosen with reference to previous studies on poverty in the agriculture and agri-food sector. These studies show that poverty is linked to the socio-demographic aspects of the actors, their sources of income and the support they receive. They also show that poverty reduction for actors in these sectors is more effective when it focuses on the least disadvantaged households. This is because they have the greatest capacity to intensify production and generate off-farm income, which is a source of resilience to poverty (Hammond *et al*., 2023). Thus, the socio-demographic variables of the direct actors in this sector are included in the model. With the exception of those that allowed the determination of the PPI score, in particular the place of residence, the size of the household, and the level of education of the head of household. Gender, age and work experience were retained. Several studies have shown that men and women have unequal access to factors of production. They have also shown differential access between young and old (Buehren, 2023; Friedson-Ridenour & Pierotti, 2019; Kehinde & Ogundeji, 2023). The variable of professional experience in this study is binary, with modalities of less than 15 years and more than 15 years. This variable, in addition to situating the level of professional experience in the sector, also makes it possible to verify which of the two groups is most affected by poverty. For almost 10 years, the weakening of the national branch of the CSS has been noted (AGASA, 2020). This is due to the massive arrival of fermented cassava pastes from neighbouring Congo Brazzaville, ready to be used to make cassava sticks. This justifies the modalities of this explanatory variable. In addition, this sub-regional trade would have led to a significant entry of new actors in this sector on the Gabonese side. Thanks to the availability of ready-to-use cassava pastes, these new actors have found opportunities for professional activities. The other explanatory variables relate to the sources of income of the respondents. These are the activities carried out in the CSS, the activities carried out outside the sector, the participation in an SLG or a tontine and the use of the income generated by the activities of the CSS. Several studies agree that farmers with off-farm income are less vulnerable to poverty (Aidoo-Mensah, 2023; Manganyi *et al.*, 2023). This justifies the choice of these variables. Similarly, participation in an SLG implies an income that exceeds daily consumption needs or a willingness

to acquire durable goods (Rozas & Gauthier, 2012). The use of the income variable is binary, its modalities are household consumption only and household consumption more acquisition of sustainable goods. It allows to establish the link between the destination of the income and the socio-demographic profile of the CSS actor. This is in line with the hypothesis already mentioned, which suggests that CSS would be an opportunity for the most vulnerable people to get out of extreme poverty.

2.6 Data processing and analysis

The data collected was regularly encoded in an Excel spreadsheet and transferred to the statistical software R studio version 4.2.1. Following the descriptive statistics (mean, percentage, standard deviation, etc.), the following analyses were made:

- Student's test: to compare the means of quantitative variables.
- Multiple linear regression: to identify the determinants of poverty in the CSS. The dependent variable (Y) is the PPI score and the explanatory variables are age, gender, participation in a SLG, main activity in the CSS, paid activity outside the CSS and work experience in the main activity. The multiple linear regression model was chosen because the dependent variable is quantitative.

The multiple linear regression model is as follows:

$$\begin{aligned}\text{PPI score} = {} & \beta 0 + \beta 1\ (\text{age}) + \beta 2\ (\text{gender}) + \\ & \beta 3\ (\text{main activity in CSS}) + \beta 4\ (\text{activity outside CSS}) + \\ & \beta 5\ (\text{experience in the activity}) + \beta 6\ (\text{participation in SLG}) \\ & + \beta 7\ (\text{income use}) + \epsilon\end{aligned}$$

In the equation, $\beta 0$ represents the constant, $\beta 1$-7 represents the coefficients associated with each explanatory variable, and ϵ represents the error term or residuals. In a multiple linear regression model, ϵ must have a normal distribution.

3 Results

3.1 Cassava stick production circuit in Haut Ogooué

Fig. 3 shows the pattern of cassava pastes for the production of cassava sticks in the HO province of Gabon. The cassava sticks consumed by households and those served in restaurants in the HO are all produced in the province. The difference concerns the origin of the cassava pastes used to make them. This paste is either obtained from fresh roots produced in the cassava fields of the province, or it is imported from Congo Brazzaville. The production of cassava

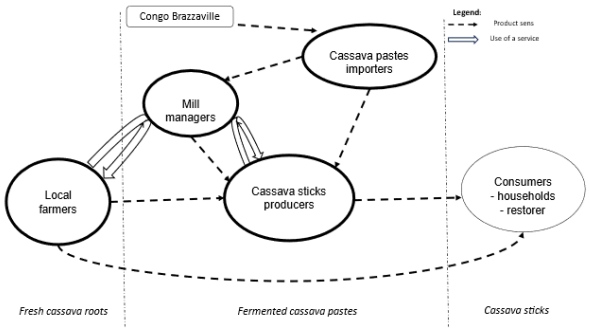


Fig. 3: *Simplified diagram of the production of cassava sticks sold in the Haut Ogooué province of Gabon in 2023.*

sticks from locally produced roots require processing steps that can be skipped by using ready-to-use pastes. These two possible origins of cassava pastes all go through cassava mills. This is an essential service sometimes associated with the retail sale of imported pastes. Crushing the cassava pastes is one of the last steps, followed by wrapping and steaming. The role played by importers of cassava pastes is highlighted in Fig. 3. These importers regularly collect this product from Congolese farmers, who conduct all the steps to obtain the cassava pastes. Thanks to this, actors are established downstream to finish the processing in the form of cassava sticks. A position that allows some to spare themselves the most strenuous activities and others to join this sector.

3.2 Socio-demographic and economic characteristics of CSS actors

Table 2 shows that the group of farmers is the oldest and the group of cassava stick producers the youngest. Regarding the gender of the actors in this sector, women are by far the most numerous. Furthermore, there are no men among the cassava stick producers. On the other hand, the three collectors - transporters of cassava paste from Congo Brazzaville to the HO - are men. About 30 % of the women are the heads of their households, and in this situation these women mainly produce cassava sticks. The size of the households and the level of education of the interviewees are homogeneous for all actors. They are poorly educated and their households have an average of 6 members. In terms of other activities carried out by the same actor in the CSS, agriculture is the most important. However, specialisation of some actors was noted. For example, 25 % of the cassava producers only carried out this activity and all the cassava paste importers did not carry out any other activity in the CSS.

Foufou is a dried presentation of ground cassava root chips. It is consumed less than cassava sticks in Gabon, and

Table 2: *Socio-demographic and economic characteristics of direct actors in the cassava stick sector (CSS) in the Haut Ogooué province of Gabon in 2023.*

	Variable	*All (n = 223)*	*Farmer (n = 30)*	*Cassava stick producer (n = 157)*	*Mill manager (n = 33)*	*Cassava pastes importer (n = 3)*
	Age (year)	44.5 ± 10.5	52 ± 10.6	42.7 ± 10.0	45.2 ± 10.1	51 ± 8.7
	Gender (Woman)	201 (90)	24 (80)	157 (100)	20 (60.6)	0
	Head of household (Woman)	62 (27.8)	7 (23.3)	53 (33.7)	2 (6.1)	0
	Household size (number)	6.1 ± 2.9	5.8 ± 2.0	6.0 ± 2.9	6.7 ± 3.6	5.7 ± 2.5
Marital status	In a relationship	159 (71.6)	23 (76.7)	104 (66.2)	29 (87.9)	3 (100)
	Single	54 (24,3	6 (20)	45 (28.7)	3 (9.1)	0
	Widow/Widower	9 (4.0)	1 (3.3)	8 (5.1)	0	0
Educational attainment	None	14 (6.4)	2 (6.7)	8 (5.1)	3 (9.0)	1 (33.3)
	Primary	66 (31.1)	6 (20)	47 (29.9)	14 (42.4)	1 (33.3)
	Secondary	133 (60.7)	21 (70)	99 (63.0)	12 (36.4)	1 (33.3)
	University	4 (1.8)	1 (3.3)	1 (0.6)	2 (6.0)	0
Other activities in the CSS*	Farmer	125 (56.1)	/	116 (74.4)	15 (45.5)	0
	Production of cassava sticks	32 (14.3)	22 (66.7)	/	9 (33.3)	0
	Mill manager	3 (1.3)	0	2 (1.3)	/	0
	Cassava pastes retailer	17 (7.6)	2 (6.6)	2 (1.3)	14 (42.4)	0
	Production and sale of foufou	17 (7.6)	17 (56.7)	0	0	0
	No	55(24.7)	7 (23.3)	39 (25.0)	6 (18.2)	3 (100)
Activities outside the CSS	No	179 (80.6)	18 (60)	133 (85.3)	26 (78.8)	2 (66.7)
	State employee	13 (5.8)	2(6.7)	7 (4.5)	3 (9.1)	1 (33.3)
	Employee in the private sector or self-employed	21 (9.5)	4 (13.3)	13 (8.3)	4 (12.1)	0
	Retired	9(4.1)	6 (20)	3 (1.9)	0	0
Experience in the main business (From 0 to 15 years old)		121 (59.6)	16 (53.3)	74 (47.1)	28 (84.8)	3 (100)
Participation in a tontine (Yes)		74 (40.1)	12 (40)	55 (35.0)	4 (12.1)	3 (100)
Use of CSS income (household consumption + investment)		53 (24.0)	13 (43.3)	33 (21.0)	5 (15.2)	3 (100)

*an individual may engage in more than one activity; Percentage in brackets.

fewer people are involved in its production. In this study, foufou producers were mainly located in the Des Plateaux department.

In terms of work experience, farmers have the highest and cassava paste importers the lowest. In terms of paid activities outside the CSS, a large majority have no off-farm income. In terms of participation in SLGs, transporters-collectors and farmers are the most involved. They are also the actors of the CSS who use the income from this sector more than the daily consumption expenditure of the households.

3.3 Poverty levels of direct actors in the cassava stick sector

Table 3 presents the average PPI scores of CSS actors and their corresponding poverty rates based on selected socio-demographic and economic characteristics. In this sector, the average PPI score is 53, which means that 30.9 % of all actors and their households live below the poverty line. This level of poverty varies according to the activities carried out, the gender and the professional experience of each person. Thus, people whose main activity in the CSS is in agriculture are the most affected by poverty. Men in this sector are much less poor than women. The difference in poverty between female- and male-headed households is more pronounced. This is because the poverty level of households in this sector is doubled if the household is headed by a woman. With regard to activities outside the CSS, a clear difference was found between actors who have income outside the CSS and those who only earn money from the CSS. CSS actors who are also government employees are particularly less affected by poverty. Actors who have worked in the CSS sector for more than 15 years are slightly less poor than CSS actors

Table 3: *Average poverty probability index (PPI) scores of actors in the cassava stick sector and corresponding poverty levels according to selected socio-demographic and economic characteristics.*

	Variable	*PPI score (out of 100)*	*Poverty rate (%)*
All the actors		53 ± 15.4	30.9
Activities in the cassava sticks sector	Farmers	51.9 ± 14.7	33.7
	Farmers of cassava sticks	52.8 ± 15.1	30.9
	Mill managers	52.9 ± 16.6	30.9
	Cassava pastes importers	75.7 ± 7.0	2.5
Activities outside the cassava stick sector	No	50.9 ± 14.6	36.6
	State employee	67.5 ± 12.8	6.4
	Employee in the private sector or self-employed	57.4 ± 16.6	21.0
	Retired	63.8 ± 15.7	9.7
Gender	Male	59.2 ± 15.2*	17.0
	Female	52.3 ± 15.3	33.7
Head of Household	Man	59.2**	17.0
	Woman	50.1	36.6
Professional experience	Under 15 years old	52.1 ± 15.9	33.7
	More than 15 years	53.0 ± 15.1	30.9
Participation in a SLG	Yes	55.6 ± 15.3***	24.0
	No	49.9 ± 15.6	39.7
Use of Revenues	Household consumption only	51.8 ± 15.7	33.7
	Household consumption + sustainable goods	56.4 ± 13.9**	23.2

* 10 %, ** 5 %, and *** 1 % significant difference.

who have worked for less than 15 years. Participation in an SLG is a real indicator of poverty, as is the use that actors make of their income from the sector. Actors who participate in SLGs and those who make investments in addition to daily household consumption expenditure are significantly less poor than those who do not.

3.4 Determinants of poverty of actors in the cassava stick sector

According to the model used, only the activity conducted outside this sector is statistically associated ($p < 0.05$) with the PPI score of direct actors in the CSS of the 7 explanatory variables. This means that the fact that a direct actor in this sector lives below the poverty line is more related to the income that he or she manages to capture outside the CSS. Thus, an actor in this sector who receives a retirement pension has a PPI score that is, on average, 14.4 points higher than those who have no income outside this sector. Since the intercept of the model score is 51, the PPI score of people in this situation rises to 67/100. Thus, actors in this sector who receive a retirement pension are 20 % less likely to live below the poverty line. The figures are practically the same for the actors who are state employees, and a little more than half if this person works in the private sector or conducts a professional activity that he or she has set up himself or herself. The other variables also explain the PPI score, but they are not statistically related to this dependent variable ($p > 0.05$).

4 Discussion

4.1 Many women want to get out of extreme poverty

This study drew up a portrait of CSS actors in the HO in Gabon and showed that they are largely women who have little access to better-paid jobs due to a lack of skills. The majority have been working in this sector for less than 15 years and almost 28 per cent of households are headed by women. These actors are striving to increase revenues from the activities that are only accessible to them. Hence the practice of several activities in the CSS. This is due to the increase in both urban poverty and rural-urban migration. These activities require almost cultural competences that people from the study area have. The trade in cassava pastes from Congo Brazzaville has opened opportunities for those who do not have a cassava field. Or who does not

want to practice all the steps necessary to get to the cassava stick. The low participation in SLGs is explained by relatively low revenues from these activities compared to other informal economic activities in Gabon (Keddad & Obiang, 2024). This could be explained by the fact that the majority of the actors surveyed have incomes that are too low to save. This explanation is reinforced by the results indicating that 76 % of people use their income solely for daily consumption expenditures.

These results are largely similar to other studies on the socio-economic profile of actors in local food value chains in general and cassava in sub-Saharan Africa in particular. Thus Omondi *et al*., (2023), in their studies in Kenya have shown that the majority of CSS actors are less advantaged people. More than 3/4 of the actors are women, who face several constraints and have limited access to the best inputs, credit or agricultural extension. Describing almost the same context of poverty and constraints for cassava farmers in Nasarawa State in Nigeria, Abubakar & Abubakar, (2023) emphasize that the cultivation of cassava in this region contributes to poverty reduction. This has also been proven in the present study. Indeed, among the actors of the CSS who have no activity outside this sector, a group of 23 actors, i.e. 10 % of the total sample, have a PPI score greater than 68. This represents an extreme poverty rate of 6 %, which is 27 points lower than the national level. However, based on the work of (Donkor *et al*., 2022; Olaomo & Molnar, 2022) significant differences between the CSS of Nigeria and Gabon were noted. In Nigeria, men are much more present than in Gabon, especially in production and processing. The average age of the actors is also somewhat lower in Nigeria and the range of products obtained from cassava roots is larger.

4.2 Cassava stick sector alone is not enough to lift people out of poverty

The results showed that extreme poverty affects just over 3 out of 10 actors in this CSS. Farmers are the most affected by poverty (33.7 %) and importers of cassava pastes are the least affected. Male-headed households are half as likely to be poverty-stricken as female-headed households. In this CSS, men are more represented in activities that require significant capital. For example, the three importers of cassava pastes are men. In addition, outside of the CSS, men are more likely to engage in paid activities. Of the 179 actors with no activities outside the CSS, only 6.7 % are men. However, the low presence of men among the respondents reduces the scope of these results. It also indicates that, in this country of natural resource rent, this sector is not sufficiently remunerative. The results of this study are in line with previous studies on poverty among economic actors in the agricultural sector. In addition, it confirms that poverty is very present among the actors of local food value chains in sub-Saharan Africa. This poverty is less present when the actors of these agri-food activities manage to generate income unrelated to their main activity (Kehinde & Ogundeji, 2023; Manganyi *et al*., 2023; Abubakar & Abubakar, 2023). De facto, this supports the hypothesis that the income generated from these agricultural activities is inadequate for a large proportion of these actors. For the most disadvantaged actors, the positive effects of these additional revenues are barely felt (Kehinde & Ogundeji, 2023). In other words, for the most precarious actors, these activities serve not to get out of poverty, but to reduce the pains of poverty in their daily lives. The present work confirms this with the results of the multivariate linear regression model that was used. It showed that when work in the CSS is complemented by a paid activity, the risk of living below the poverty line is significantly reduced for those concerned. In Farmers without off-farm activities are the most likely to live in poverty. In Kenya, Ouya *et al*., (2020) found a PPI score of 51.1 for smallholder farmers. This score increases by 4.3 points on average if the household has off-farm income. The study by Hammond *et al*. (2023) of the dynamics and determinants of poverty among smallholder farmers in East Africa found that households that started out less advantaged struggled to move out of poverty despite assistance. This is because they are less able to take advantage of existing opportunities outside the agricultural sector. Estrella *et al*. (2022) in Honduras, assessed the ability of certification programmes undertaken by coffee farmers to lift the households concerned out of poverty. The results indicated that the average PPI score of non-certified coffee farmers was 50.6 compared to 53.1 for those of coffee farmers with the best certification. The poverty rate only fell by 4 %, from 60 to 56 %. The study concludes that improving the social and economic conditions of coffee producers are prerequisites for reducing poverty. Without this, coffee smuggling to other countries or mass immigration will remain a challenge for Honduras (Estrella *et al*., 2022). The low level of revenue derived from the activities of this CSS by most actors explains the conclusion reached by this Honduras study. To significantly reduce the risk of living below the poverty line for direct CSS actors in the HO, a source of income outside this sector is necessary. This additional income will allow them to acquire assets that will lift them out of extreme poverty. Benson & De Weerdt (2023) reached the same conclusions in Malawi with a study population that was extended to all rural agricultural activities in the country. They stated: "In developing strategies for rural economic and human development in Malawi, accelerating agricultural production growth, particularly through increased productivity,

and increasing the returns to farming are necessary, but incomplete solutions. Equal attention must now be paid to how workers in farming households can also qualify for and obtain good off-farm jobs" (Benson & De Weerdt, 2023). The risk of living below the poverty line for people importing cassava paste from Congo Brazzaville to HO in Gabon was estimated at 2.5 %, compared to 33.7 % for farmers. This indicates that, with sufficient investment, CSS activities can lift its stakeholders out of poverty. This is also supported by Hammond *et al*. (2023) and Odido & Nwankwo (2021), who point out in their work that poverty, or the ability of agri-food actors to get out of it, depends on the profile of the actor, their human and social capital, and their ability to take advantage of available opportunities.

5 Conclusion and recommendations

A study was conducted to investigate the determinants of poverty among CSS actors in the HO in southeastern Gabon. Results show that elderly women, with little education largely dominate this sector. Nearly 30 % of the households concerned are headed by women. Regarding the level of poverty, 30.9 % of direct actors live below the poverty line. Farmers are the most affected by this phenomenon. According to the statistical model used, living below the poverty line was statistically associated with whether they were engaged in paid work outside the CSS. Based on the results of this work, the following recommendations are made:

In order to achieve long-term reductions in extreme poverty in Gabon, public policies should be orientated towards the endogenous development of communities and the strengthening of household livelihoods. Extreme poverty has affected almost one in three Gabonese people for decades, and government initiatives to reduce this poverty have not been successful because they do not strengthen the livelihoods of those receiving assistance. These are transfers of funds and/or the provision of services without compensation, which is certainly an inefficient way to distribute the fruits of the country's natural resource rent. We recommend the professional integration of the unemployed and actions that increase the resilience of households. Integration could be achieved in agri-food sectors that involve food produced and consumed in the locality, such as cassava sticks, as the required skills are within the reach of the poorest and above all, their integration will be easier. This approach also offers the opportunity for the authorities to begin the identification of these activities and their actors, which process should be a prerequisite for the support provided. In terms of enhancing the resilience of individuals and households, producer organisations and agricultural advisory and extension agencies should encourage households to diversify their income sources through off-farm activities, provided that these activities are compatible with those carried out in the food value chain.

And finally, researchers should continue their efforts to identify the conditions under which activities in the cassava sector can alone lift their actors out of extreme poverty. The findings indicate that importers of cassava pastes and certain cassava stick producers are not significantly impacted by extreme poverty. To this end, an experimental system must be established that either separates the income of those involved from the cassava sector, or exclusively engages with individuals whose income is derived exclusively from the cassava sector.

Conflict of interest

The authors declare that they have no conflict of interest.

References

AGASA (2020). Vers la mise aux normes sanitaires de la filière manioc. AGASA - Agence Gabonaise de Sécurité Alimentaire. https://www.agasa.site.

Aidoo-Mensah, D. (2023). Determinants of savings frequency among tomato farmers in Ghana. *Cogent Economics & Finance*, 11(1), 18. doi: 10.1080/23322039.2023.2196862.

Atta Doha, L. T., & Sogan, M. (2018). *Diagnostic économique de la commercialisation du manioc et ses dérivées dans la commune de Dogbo*. Technical Report Université de Parakou. https://biblionumeric-univparakou.org:9443/jspui/handle/123456789/895.

Benicourt, E. (2001). La pauvreté selon le PNUD et la Banque mondiale. *Études rurales*, 3, 35–53.

Benson, T., & De Weerdt, J. (2023). Employment options and challenges for rural households in Malawi. http://massp.ifpri.info/files/2023/04/Working-Paper-40-Malawi-CEM-ag-background-paper-Apr2023-revised.pdf.

Buehren, N. (2023). Gender and Agriculture in Sub-Saharan Africa: Review of Constraints and Effective Interventions. World Bank's Africa Gender Innovation Lab, p. 43. https://openknowledge.worldbank.org/bitstreams/19966f50-f68b-42c9-9088-9098dfaca729/download.

Diwakar, V., & Shepherd, A. (2022). Sustaining escapes from poverty. *World Development*, 151, 105611. doi: 10.1016/j.worlddev.2021.105611.

Donkor, E., Onakuse, S., Bogue, J., & de los Rios Carmenado, I. (2022). Income inequality and distribution patterns in the cassava value chain in the Oyo State, Nigeria: A gender perspective. *British Food Journal*, 124(13), 254–273. doi: 10.1108/BFJ-06-2021-0663.

Estrella, A., Navichoc, D., Kilian, B., & Dietz, T. (2022). Impact pathways of voluntary sustainability standards on smallholder coffee producers in Honduras: Price premiums, farm productivity, production costs, access to credit. *World Development Perspectives*, 27, 100435. doi: 10.1016/j.wdp.2022.100435.

FAO (2023). FAO Country Profiles: Gabon. Food and Agriculture Organization of the United Nations. http://www.fao.org/countryprofiles/index/en/?iso3=GAB.

FAOSTAT (2024). Crops and livestock products/ Gabon/ Cassava. https://www.fao.org/faostat/en/#data/QCL.

Friedson-Ridenour, S., & Pierotti, R. S. (2019). Competing priorities: Women's microenterprises and household relationships. *World Development*, 121, 53–62. doi: 10.1016/j.worlddev.2019.04.008.

Hammond, J., Pagella, T., Caulfield, M. E., Fraval, S., Teufel, N., Wichern, J., Kihoro, E., Herrero, M., Rosenstock, T. S., & van Wijk, M. T. (2023). Poverty dynamics and the determining factors among East African smallholder farmers. *Agricultural Systems*, 206, 103611. doi: 10.1016/j.agsy.2023.103611.

Innovations for Poverty Action (2023). Poverty Probability Index (PPI). https://www.povertyindex.org/country/south-africa.

Jobarteh, M. (2024). Gabon. https://futures.issafrica.org/geographic/countries/Gabon future.Issafrica.Org.

Keddad, B., & Obiang, J. R. O. (2024). Determinants of deposits volatility: The case of the microfinance sector in Gabon. *Research in International Business and Finance*, 67, 102108. doi: 10.1016/j.ribaf.2023.102108.

Kehinde, A. D., & Ogundeji, A. A. (2023). Distributive impacts of non-farm income on output and farm income of cassava farmers in Southwestern Nigeria. *Scientific African*, 19, e01535. doi: 10.1016/j.sciaf.2022.e01535.

Laboratoire national de cartographie (2020). Carte administrative du Gabon. http://journals.Openedition.org/cybergo/decannxe/image/24196.

Lepengué, A. N., Nzengue, E., Mombo, S., Essougou, C. Y., Ontod, D. S. T.-T., Mokea-Niaty, A., & Mbatchi, B. (2019). Effet du Manganèse sur la Croissance de la Patate Douce (Ipomoea batatas L.) au Gabon. *European Scientific Journal*, 15(24), 281. doi: 9044/esj.2019.v15n24p281.

Madoungou, L. N. S. (2022). S'alimenter en temps de Covid-19 dans les quartiers sous-intégrés de Libreville: Quelques pistes de solutions face à l'insuffisance des produits agricoles locaux. *Bulletin de la Société Géographique de Liège*, 79, 14. doi: 10.25518/0770-7576.6763.

Manganyi, B., Lubinga, M. H., Zondo, B., & Tempia, N. (2023). Factors Influencing Cassava Sales and Income Generation among Cassava Producers in South Africa. *Sustainability*, 15(19). doi: 10.3390/su151914366.

Neema Ciza, A., Vwima, S., Lebailly, P., & Azadi, H. (2022). Agricultural Development in the Fight against Poverty: The Case of South Kivu, DR Congo. *Land*, 11(4). doi: 10.3390/su151914366.

Odido, J., & Nwankwo, F. O. (2021). Effect of Socio-Economic Characteristics of Farmers' Cooperative Societies on Poverty Reduction among Rural Dwellers of Ogun State, Nigeria. *Forshen Hub International Journal of Entrepreneurial and Cooperative Studies*, 4(2), 14–26.

Okowa Abdullahi, A., & Abbas Uthman, A. (2023). The Impact of Cassava Production on Poverty Reduction in Nasarawa State, Nigeria. *African Journal of Economics and Sustainable Development*, 6(2), 139–150. doi: 10.52589/AJESD-FJWUW9EK.

Olaomo, O. K., & Molnar, J. J. (2022). Building an Inclusive Value Chain: Gender Participation in Cassava Marketing and Processing in Nigeria. *Environ. Sci. Ecol. Curr. Res*, 3. doi: 10.54026/ESECR/1078.

Omondi, S. W., Tana, P., Lutomia, C., Makini, F., & Wasilwa, L. (2023). Exploring inclusiveness of vulnerable and marginalized people in the cassava value chain in the Lake Region, Kenya. *Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS)*, 124(1). doi: 10.17170/kobra-202302217527.

Ouya, F., Ayuya, O. I., & Kariuki, I. M. (2020). Effects of agricultural intensification practices on smallholder farmers' livelihood outcomes in Kenyan hotspots of Climate Change. *East African Journal of Science, Technology and Innovation*, 2(1). doi: 10.37425/eajsti.v2i1.110.

Perspectives Monde (2024). Gabon–Population totale | Statistiques. https://perspective.usherbrooke.ca/bilan/servlet/BMTendanceStatPays.

Pottier, P., Allogho-Nkoghe, F.-M., Koumba, J.-P., & Ntsame Ondo, N. (2017). *Chapitre 7-L'urbanisation à l'assaut du littoral du Gabon*. Géollitomer, Raponda-Walker.

Pourtier, R. (1980). La crise de l'agriculture dans un État minier: Le Gabon. *Études rurales*, 77, 39–62.

Recensement Général de la Population et de l'Habitat et du Logement (RGPHL) (2015). Résultats globaux du Recensement Général de la Population et du Logement de 2013 du Gabon. https://gabon.unpfpa/ direction Générale de la Statistique (DGS) Libreville.

RGA (2020). Recensement général de l'agriculture du Gabon. Système permanent intégré des statistiques agricoles, Ministère de l'agriculture, de l'élevage, de la pêche et de l'alimentation. https://statgabon.ga/.

Rozas, S. T., & Gauthier, B. (2012). Les tontines favorisent-elles la performance des entreprises au Cameroun? *Revue d'économie du développement*, 1, 5–39. doi: 10.3917/edd.261.0005.

Tchekote, H., Tchinda, F. H., Noubactep, C., & Ngako, M. A. (2020). Le Marché Dans La Construction De L'inter-Territorialité Transfrontalière: Le Cas Du Marché De Kye-Ossi Dans L'analyse A Travers La Distribution Des Produits Agricoles Entre Le Cameroun, La Guinée Équatoriale Et Le Gabon (Sud Cameroun). *European Scientific Journal*, 16(11). doi: 0.19044/esj.2020.v16n11p205.

Tessier, J., Rigourd, C., & Dugue, P. (2019). Relancer le conseil et la vulgarisation agricoles en Afrique subsaharienne—Pour de nouvelles politiques en cohérence avec les réalités de terrain.

UNDP (2022). Indice mondial de pauvreté multidimensionnelle (IPM) 2022. Programme de Développement des Nations Unies. https://www.undp.org.

UNICEF (2022). Country Office Annuel Rapport Gabon. UNICEF. www.unicef.org/Gabon.

Wali Wali, C., & Makita-Ikouaya, E. (2022). Mobilités et enjeux sanitaires aux confins du Gabon et du Congo à l'heure de la COVID-19. *L'Espace Politique. Revue en ligne de géographie politique et de géopolitique*, 44. doi: 10.4000/espacepolitique.10132.

World Bank (2024). Overview, World Bank, Middle Income Countries. https://www.worldbank.org/en/country/mic/overview.

Wunder, S. (2003). When the Dutch disease met the French connection: Oil, macroeconomics and forests in Gabon. Center for International Forestry Research. doi: 10.17528/cifor/001406.

Zakaria, W. A., Indah, L. S. M., Endaryanto, T., & Hermawan, D. (2022). Income and welfare level of cassava farmers during covid-19 pandemic era in Lampung Province. *IOP Conference Series: Earth and Environmental Science*, 1027(1). doi: 10.1088/1755-1315/1027/1/012016.