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Research Article

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Sociodemographic characterization of Cassava farmers in Cameroon

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ABSTRACT

The aim of this study was to profile Cameroonian cassava farmers in the Adamawa, Centre, East and South regions of Cameroon. Four (04) quantitative and ten (10) qualitative variables were analyzed using correlation analysis and Chi-square-based association testing (alpha=0.05) respectively. The results suggest that cassava farming is practiced more by women than by men. Also, the average age of cassava farmers across regions is 42.2 years. Some of Cameroon's cassava farmers own farmland, and few have fields that are specifically devoted to Cassava cultivation due to the practice of mixed cropping and crop rotation. Moreover, the majority of Cameroonian cassava farmers consume the cassava they grow and process, and most of them are well-educated, being able to read and write, with 51% of women involved. Smartphone use is very widespread among Cassava farmers in the Centre and South regions, where the proportions between the two sexes are 26.1% (men) versus 30.3% (women), and 30.9% (men) versus 29.4% (women) respectively. The same applies to internet access. Farmers in Adamawa and the East have little access to the internet. Furthermore, very few cassava farmers belong to farmers' organizations, and they use the income from selling the cassava they produce and process to ensure their household's food and health security, and to send their children to school. Finally, participation in community activities is not widespread in Adamawa and the South and over the last five years, very few cassava farmers have acquired assets from the sale of cassava.

KEYWORDS: Sociodemographic characterization, Cassava farmers, Food security, Cameroon

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INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a vital staple crop in many African countries, including Cameroon (Burns *et al.*, 2010). Its starchy roots provide a fundamental source of dietary energy for millions of people, particularly smallholder farmers (Prudencio & Al-Hassan, 1994; Kolawole *et al.*, 2010; Jackson *et al.*, 2020; Ngongo *et al.*, 2022). Beyond sustenance, cassava plays a crucial role in local economies, cultural practices, and livelihoods. Understanding the sociodemographic context of cassava farming is essential for sustainable agricultural development, policy formulation, and targeted interventions. Cameroon, with its diverse agroecological zones, hosts a vibrant cassava sector (Tize *et al.*, 2021; Bilong *et al.*, 2022; Doungous *et al.*, 2022). The crop thrives across various regions, from the lush forests of the South to the savannahs of the Adamawa. However, behind the lush green leaves and tuberous roots lie intricate stories of farmers, their families, and their interactions with cassava. Generally, the faces of cassava farmers includes; 1) Age and Experience: Cassava cultivation is often a family affair, passed down through generations. 2) Gender dynamics shape cassava farming: Women play a central role, not only in planting and harvesting but also in processing cassava into various products. Their expertise in cassava transformation is a cornerstone of food security. Yet, gender disparities persist, affecting access to resources, decision-making power, and income distribution (Masamha *et al.*, 2018; Teeken *et al.*, 2018; Olaosebikan *et al.*, 2019). 3) Education and Knowledge: Education levels among cassava farmers vary. Some have formal education, while others rely on traditional wisdom (Tafesse *et al.*, 2021). 4) Household Composition: Cassava farming is intertwined with family structures. Large households often collaborate in planting, weeding, and harvesting. The number of household members involved in agriculture influences productivity, resource allocation, and labor distribution (Alamu *et al.*, 2019). This study aimed to comprehensively characterize cassava farmers in Cameroon from a sociodemographic perspective.

MATERIALS AND METHODS

Data Collection

Nine interviewers underwent training to use the Kobo toolbox application on tablets for data collection. These interviewers were then assigned specific data collection sites based on two criteria: their familiarity with the site

(in either the Adamawa, Center, East, or South region) and the language spoken by the respondents (to facilitate communication). The data collection process spanned a two-week period.

Study Variables

Four (04) quantitative variables and ten (10) qualitative variables were used in this study (Table 1). The *region of origin* (V6) variable and the *sex of respondent* (V27) variable were only used for data aggregation.

The quantitative variables included the age of the respondent (V28), the number of the respondent's household members actively involved in farming (V41), the total surface area of land owned by the respondent (V72) and the surface area of land owned by the respondent which is dedicated to growing only cassava (V82).

The qualitative variables included the ability of the respondent to read and write correctly (V31), the possession of a personal smartphone by the respondent (V48), the respondent's access to internet connection (V49), the respondent's membership in a farmers' association (V325), the respondent's within-household consumption of Cassava (V495), the respondent's within-household contribution of income generated from Cassava sales to other food costs (V497), the respondent's within-household contribution of income generated from Cassava sales to health needs V499), the respondent's within-household contribution of income generated from Cassava sales to schooling needs (V501), the respondent's participation in community activities (V503) and the respondents acquisition of assets with accumulated income generated from Cassava sales over the last 5 years (V512).

Table 1: Variables used to perform the sociodemographic characterization of Cassava farmers for this study

	Code	Variable
		Quantitative Variables
1	V6	Region/Province
2	V28	How old are you?
3	V41	How many members of your household are actively involved in farming?
4	V72	What is the total area of land owned? (ha)
5	V82	What area is sown to cassava? (ha)
		Qualitative Variables
1	V27	Sex of respondent
2	V31	Are you able to read and write correctly?
3	V48	Do you have your own smartphone?
4	V49	Do you have access to internet?
5	V325	Do you belong to a farmers' association?
6	V495	Did you consume some of the cassava harvested during the previous season?
7	V497	Does the income from cassava contribute to the household's other food costs?
8	V499	Does the income from cassava help to cover your household's health needs?
9	V501	Does the income from cassava help to cover the schooling needs of the members of your household?
10	V503	Do you take part in community activities?
11	V512	Over the last five years, have you acquired any assets from your cassava income?

Data Cleaning

The original dataset contained 630 entries. To preprocess the data, several steps were taken. First, all values in the variable V6 were converted to lowercase. Next, only rows containing one of the four unique entries in V6 (Adamawa, Center, East, or South) were retained. This filtering process resulted in 508 entries. Additionally, all spaces between letters in categorical variables were removed. Any rows with missing data were also eliminated, resulting in a final dataset of 416 entries. These remaining entries were then used for subsequent analysis.

Data Analysis

The variables were analyzed using Python 3.11. Qualitative variables were examined by calculating percentages for men and women. Additionally, association analyses were performed using the Chi-square test (with a significance level of alpha=0.05) to explore relationships among qualitative variables. For quantitative variables, descriptive statistics (including mean, mode, and range) were computed, along with correlation analysis.

RESULTS AND DISCUSSION

Descriptive Analysis of Categorical Variables

Ability to read and write correctly

Regarding the question of literacy (V31), in the four selected regions, 92.3% of cassava farmers comprising 41.3% men and 51.0% women confirmed their ability to read and write (Figure 1a). Conversely, 7.7% of crop farmers, 3.1% men and 4.6% women responded negatively. These findings indicate an increasing interest in education among women (51%), although some remain uninterested. Notably, in the Adamawa region, 63.6% of cassava farmers, 54.5% men and 9.1% women acknowledged proficiency in reading and writing, compared to 36.4% among men (Figure 1b). In the Center region, there is a favorable trend among women who demonstrate proficiency in reading and writing, with 57.7% of them achieving this, compared to 40.1% of male farmers. This data is based on a total workforce of 97.9% comprising both male and female farmers. However, 2.1% of female cassava farmers in this region still struggle with literacy (Figure 1c). In the East region, specifically in Bertoua and Batouri, a higher percentage of female farmers (48.2%) excel in reading and writing compared to their male counterparts (41.5%). Overall, 89.7% of farmers in this region possess these skills. Among those who face challenges, female cassava farmers (6.7%) outnumber male cassava farmers (3.6%), resulting in a combined 10.3% (Figure 1d). Finally, Figure 1e reveals that 7.4% of cassava farmers comprising 2.9% male cassava farmers and 4.4% female cassava farmers

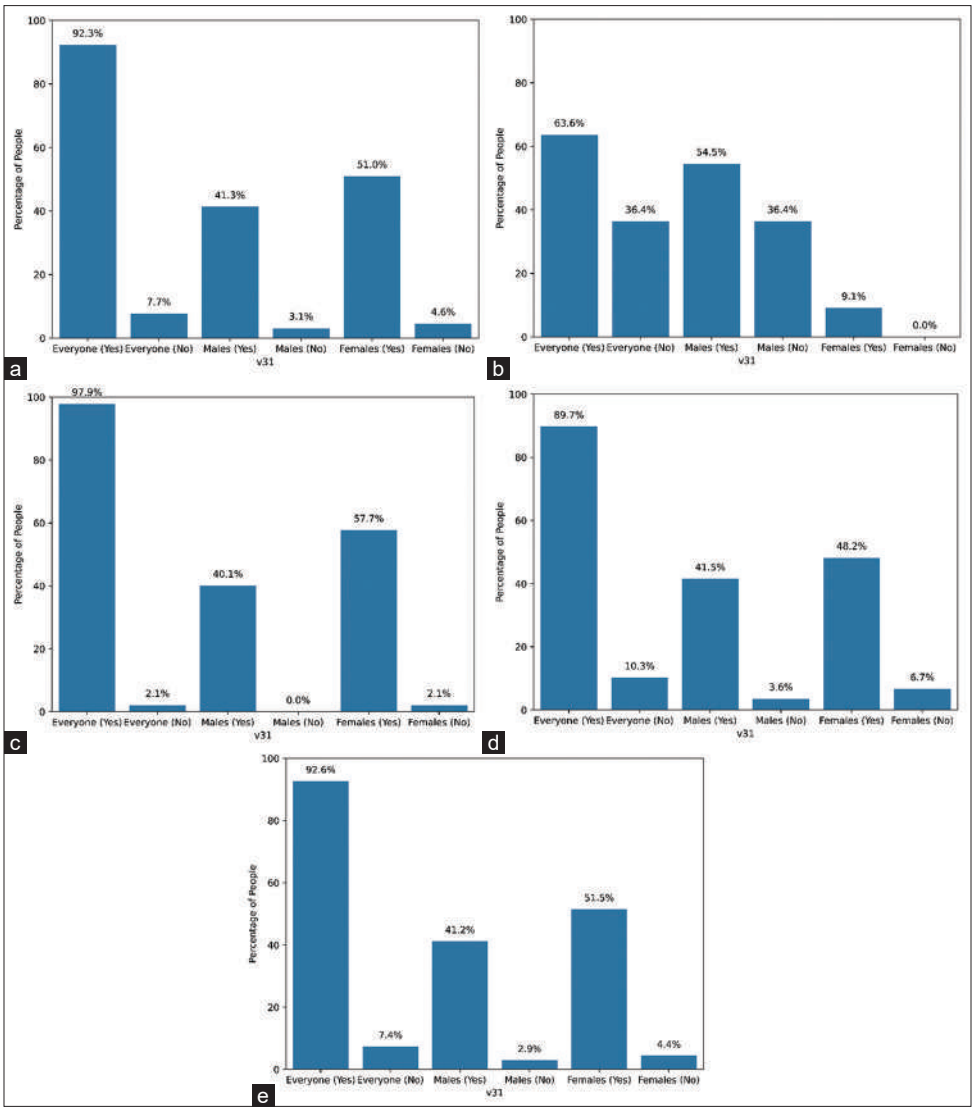

Figure 1: Ability to read and write correctly. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

still struggle with literacy. On a positive note, in the South region, a significant proportion (92.6%) of cassava farmers, including 41.2% male and 51.5% female, have received an education.

Possession of a personal smartphone

Based on the region-wide data collected for variable V48 (ownership of personal smartphones) (Figure 2a), 49% of cassava farmers comprising 24% of men and 25% of women own a smartphone. Conversely, 51% of cassava farmers, 20.4% men and 30.5% women do not own one. Notably, the Adamawa region reports the lowest ownership rate (18.2%), where all male farmers possess Android phones. However, 72.7% of male farmers, compared to 9.1% of female farmers, lack smartphone ownership, resulting in an overall percentage of 81.8% (Figure 2b). In the Centre region (Figure 2c), the percentage of farmers owning smartphones is higher (56.3%) than in the Adamawa, East (41.5%), and South (60.3%) regions. Interestingly, in this case, the number of women (30.3%) surpasses that of men (26.1%) in smartphone ownership within these regions. Furthermore, 43.7% of cassava farmers do not own smartphones, including 14.1% of men and 29.6% of women. In contrast to the South region (where 60.3% of cassava farmers own smartphones), the East region reports a lower ownership rate, with 41.5% of cassava farmers having smartphones. Among them, 20.5% are men, and 21.0% are women (Figure 2d). However, there is a higher proportion of farmers without smartphones: 24.6% of men and 33.8% of women fall into this category. In the South region, 60.3% of farmers own smartphones, with a distribution of 30.9% men and 29.4% women. Conversely, 39.7% of cassava farmers, comprising 13.2% of men and 26.5% of women do not have Android phones (Figure 2e).

Access to internet connection

The findings indicate that 51.4% of all cassava farmers in these regions have internet access (V49), 25.5% male and 26%

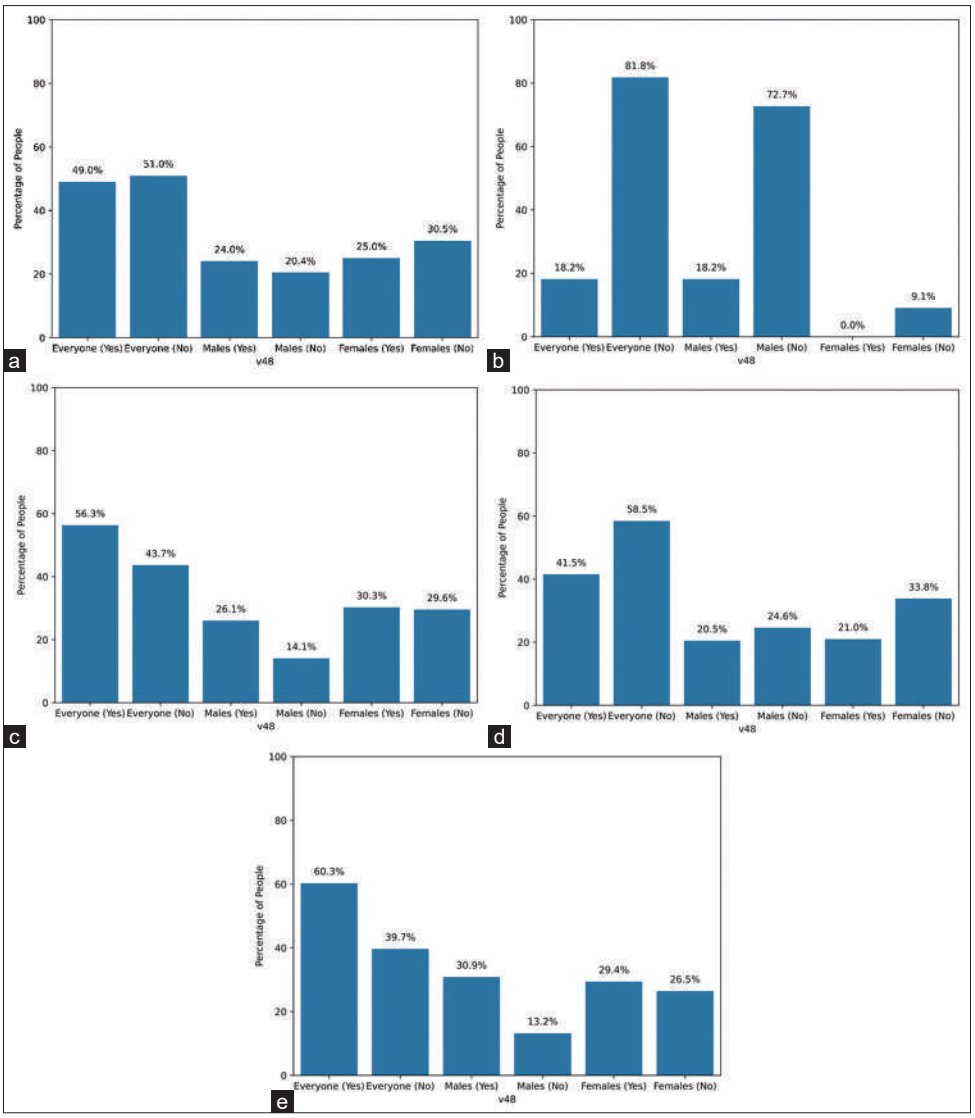

Figure 2: Possession of a personal smartphone. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

female. Conversely, 48.6% of cassava farmers lack access, with 19% being men and 29.6% women (Figure 3a). Interestingly, the results for Variable V49 align with those for Variable V48 (smartphone ownership). Specifically, 18.2% of cassava farmers (all male) lack internet access. Additionally, 72.7% of cassava farmers comprising 72.7% men and 9.1% women do not have internet access Figure 3b). In Figure 3a, it appears somewhat perplexing that 51.4% of cassava farmers have internet access, while in Figure 2a, only 49% of them own smartphones. This discrepancy could be attributed to several factors. For instance, some of these farmers might own computers, or there could be other household members with smartphones who also use the internet. Additionally, even if they don't personally own smartphones, their areas may be covered by an internet network (as indicated in Figure 3a). Furthermore, Figure 3d reveals that 41% of cassava farmers (comprising 21% of men and 20% of women) claim to have internet access, while 59% (including 24.1% of men and 34.9% of women) do not. Interestingly, these results closely mirror those found in variable V48, which asks whether individuals have their own smartphones. Figure 3c shows that in the Center Region, about 36% of respondents don't access the internet, while 64% access it. Also, even though females (35.2%) access the internet more than males (28.9%), even more females (24.6%) don't access the internet as compared to males (11.3%).

Figure 3e shows that in the South Region, the situation is not very different. Approximately 40% of respondents don't access the internet, which is higher than in the Center Region. About 60% use access the internet, suggesting slightly greater challenges in internet accessibility in this region. In partial contrast to the South Region, even though females (27.9%) access the internet less than males (32.4%), even more females (27.9%) don't access the internet as compared to males (11.8%).

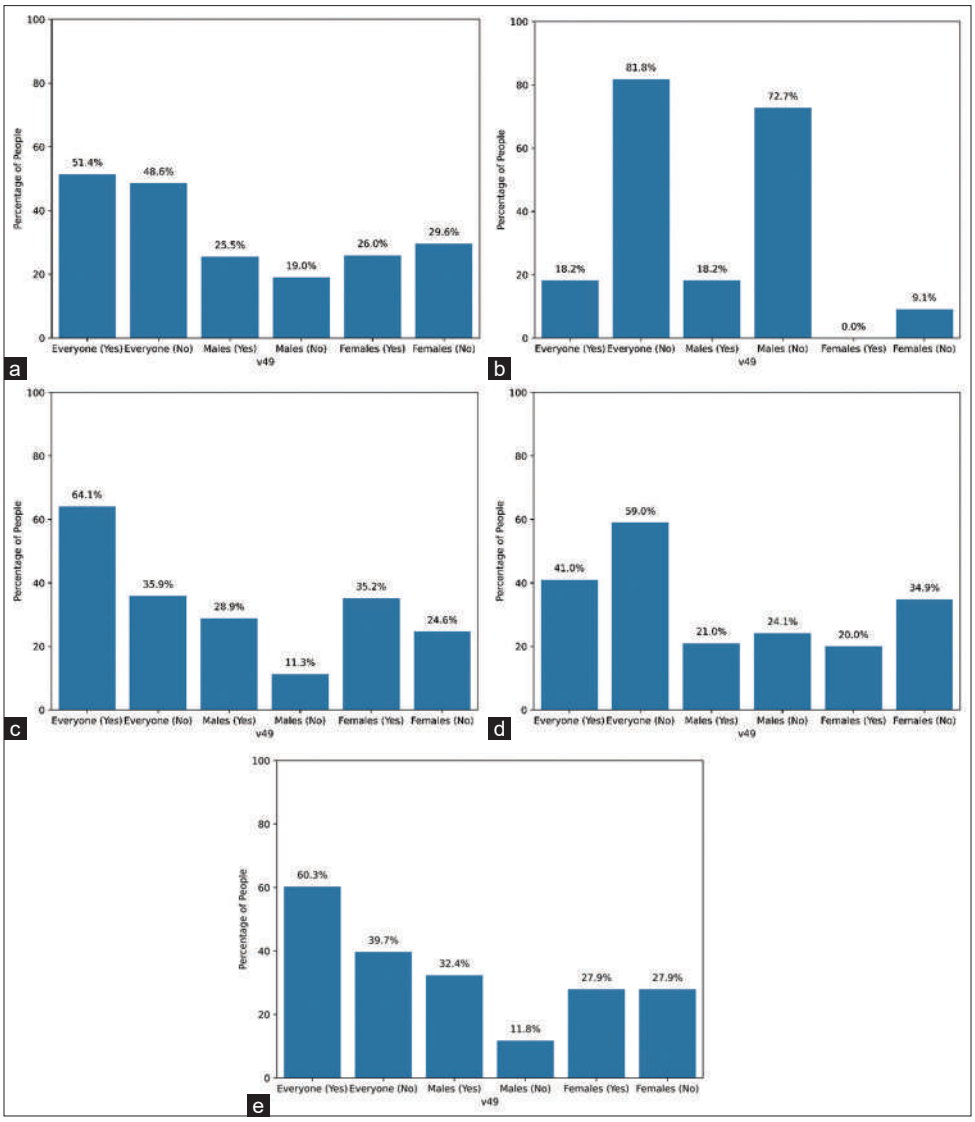

Figure 3: Access to internet connection. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

Membership in a farmers' association

In the combined regions of Adamawa, Centre, East, and South, a mere 24.8% of cassava farmers are affiliated with farmers' associations, as indicated in Figure 4a. Conversely, a significant majority (75.2%) remain unaffiliated with any association. Notably, among cassava farmers, 15.4% of females are members of producer organizations, contrasting with only 9.4% of male cassava farmers. Focusing on the Adamawa region, the inquiry regarding cassava farmers' affiliation with farmers' associations reveals that 9.1% all of whom are men belong to a farmers' associations (Figure 4b). In contrast, a substantial 90.9% of cassava farmers are not associated with any farmers' association, comprising 81.8% men and 9.1% women. In the Centre region, Figure 4c demonstrates that 74.6% of cassava farmers are not part of any farmers' organization, including 26.8% of men and 47.9% of women. Conversely, 25.4% of these cassava farmers are farmers' association members, with 13.4% being men and 12.0% women. In the East region (Figure 4d), 7.2% of men and 17.9% of women are affiliated with farmers' associations, totaling 25.1%. However, a substantial 74.9% of manual farmers both men (37.9%) and women (36.9%) do not belong to any farmers' association. Lastly, in the South region, 75% of cassava farmers comprising 36.8% men and 38.2% women are not part of any farmers' association. Conversely, 25% of cassava farmers, 7.4% of men and 17.6% of women are members of such associations (Figure 4e).

Within-household consumption of Cassava

In a comprehensive analysis across all study sites (Figure 5a), it was found that 72.1% of cassava farmers comprising 30.5% of men and 41.6% of women consumed some of the cassava harvested from their fields during the last season. Notably, a minority (27.9%) refrained from consuming any cassava, with equal representation on both sides (13.9%). In the Adamawa region (Figure 5b), 54.5% of cassava farmers, 45.5% of whom were men and 9.1% women consumed cassava from their

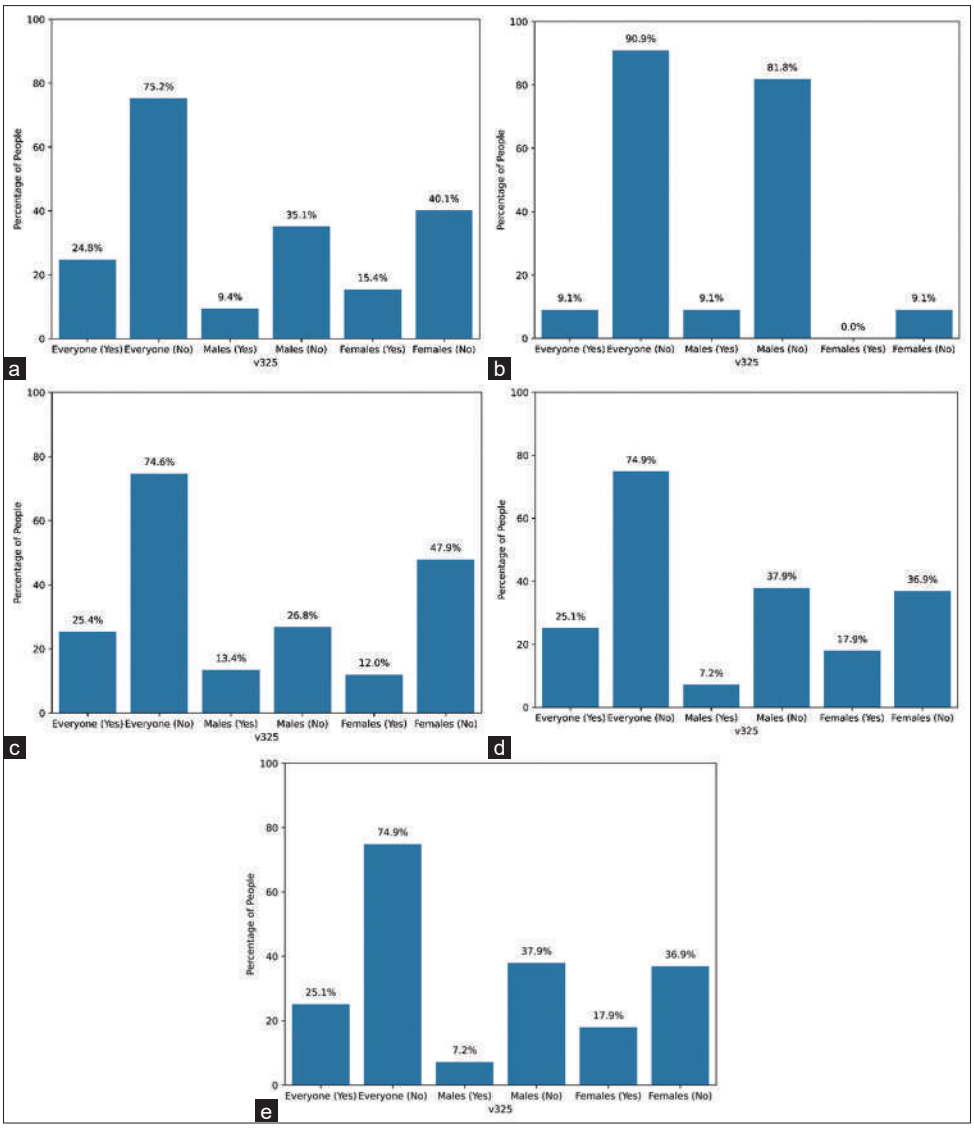

Figure 4: Membership in a farmers' association. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

fields during the last harvest. Conversely, the remaining 45.5% of cassava farmers (all men) did not partake in cassava consumption. In the Centre region (Figure 5c), a substantial proportion (88.7%) of cassava farmers comprising 33.1% of men and 55.6% of women utilized cassava during the last harvest. In contrast, the East region (Figure 5d) saw fewer abstentions (11.3%), with 7% being men and 4.2% women. Interestingly, this trend appears to reverse when compared to the South. Specifically, 76.9% of cassava farmers, 33.8% of men and 43.1% of women consumed the cassava harvested from their fields during the last harvest. Conversely, only 23.1% refrained from eating cassava, with a nearly equal split between men (11.3%) and women (11.8%). In the South region (Figure 5e), a mere 26.5% of cassava farmers admitted to consuming cassava from their fields during the last harvest. Among these, 13.2% were men, and an equal percentage (13.2%) were women. The majority (73.5%), comprising 30.9% of men and 42.6% of women, did not partake in cassava consumption.

Within-household contribution of income generated from Cassava sales to other food costs

According to Figure 6a, income generated from the sale of cassava plays a significant role in covering food costs for cassava-growing households (with a prevalence of 61.5%). Interestingly, this practice is more common among women (33.9%) than men (27.6%). For those who do not engage in this practice, they constitute 38.5% of the total comprising 16.8% men and 21.6% women. In the Adamawa region (Figure 6b), slightly over half of cassava farmers, 45.5% of whom are men and 9.1% women rely on income from cassava sales to meet their household food requirements. Conversely, the remaining 45.5% (all men) do not utilize this income source. In the Centre region (Figure 6c), a substantial 79.6% of cassava farmers, 32.4% men and 12.7% women use income from cassava sales for their household

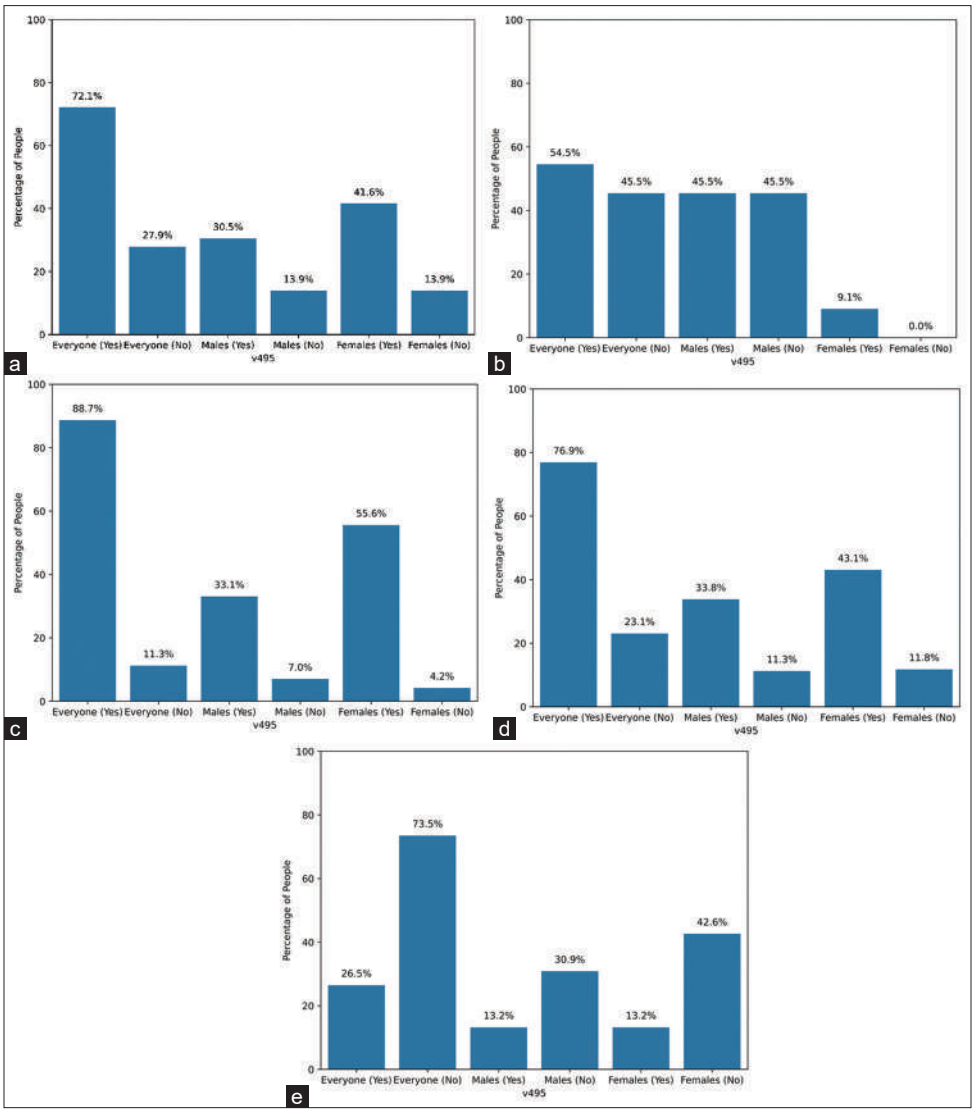

Figure 5: Within-household consumption of Cassava. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

food rations. However, 20.4% of cassava farmers in this region do not rely on this income for food expenses, including 7.7% of men and 12.7% of women. In the East region (Figure 6d), 57.4% of cassava farmers utilize income from cassava sales to cover other household food costs, with 26.7% being men and 30.8% women. Conversely, a combined 42.6% of cassava farmers do not use this income source for household food expenses, including 18.5% men and 24.1% women. In the South region (Figure 6e), 36.8% of cassava farmers confirm using income from cassava sales for other household food costs. Among these, 17.6% are men, while 19.1% are women. Conversely, 63.2% of cassava farmers do not rely on this income, comprising 26.5% men and 36.8% women.

Within-household contribution of income generated from Cassava sales to health needs

In general, 61.3% of cassava farmers (27.2% men and 34.1% women) utilize income from cassava sales to cover their household's health needs, as indicated by variable 499. However, 38.7% of cassava farmers comprising 17.3% of men and 21.4% of women do not rely on income from cassava sales for health-related expenses (Figure 7a). In the Adamawa region, we find consistent results for variable 497. Specifically, 54.4% of cassava farmers, 45.5% of males and 9.1% of females believe that income from cassava sales helps cover health needs within cassava-farming households. Conversely, 45.5% of cassava farmers (all male) state that income from cassava sales does not contribute to household health needs (Figure 7b). In the Centre region (Figure 7c), a substantial 79.6% of cassava farmers acknowledge that income from cassava sales assists in managing household health concerns (comprising 31.7% men and 47.9% women). Conversely, 20.4% of cassava farmers express a negative view. Among these, 8.5% are men, and 12% are women. Notably, these findings align with those observed for variable 497, which assesses whether cassava sales contribute

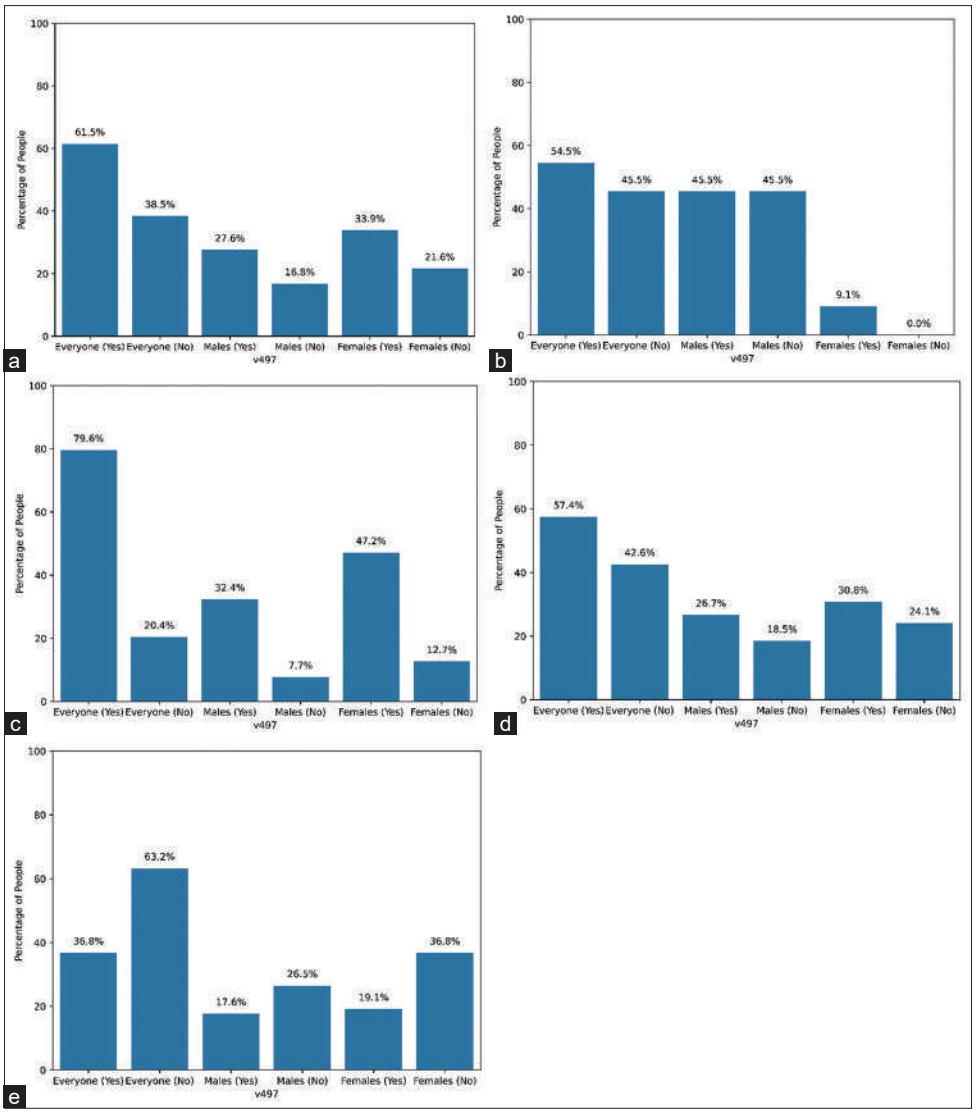

Figure 6: Within-household contribution of income generated from Cassava sales to other food costs. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

to food purchases in households. In the East Cameroon region (Figure 7d), just over half of cassava farmers (57.4%) recognize the contribution of income from cassava sales to their households' health needs. This recognition extends to 26.7% of men and 30.8% of women. Conversely, among cassava farmers who do not perceive this contribution, 42% hold this view comprising 18.5% men and 24.1% women. Importantly, the data for variable 499 mirror those of variable 497. Finally, Figure 7e highlights that only a few cassava farmers (16.2% men and 19.1% women) rely on income from cassava sales to meet their household health needs. In contrast, 64.7% of cassava farmers, 27.9% men and 36.8% women do not consider this income source sufficient. Overall, income from cassava sales significantly impacts the health and well-being of cassava farmers across the Adamawa, Centre, East, and South regions of Cameroon (Figure 7a).

Within-household contribution of income generated from Cassava sales to schooling needs

In the four regions, 56.5% of cassava farmers answered affirmatively to the question about whether revenues from cassava sales contribute to covering their household members' schooling needs. Among those who agreed, 25.7% were men, and 30.8% were women. Conversely, 43.5% disagreed with this statement, with 18.8% of men and 24.8% of women expressing disagreement (Figure 8a). In the Adamawa region, the trend diverges from other variables (V497 and V499). Specifically, 45.5% of cassava farmers (36.4% men and 9.1% women) believe that income from cassava sales helps meet their household members' schooling needs. In contrast, 54.5% of cassava farmers (all men) do not share this opinion (Figure 8b). In the Center region, 71.8% of farmers allocate part of their cassava sales for schooling needs. This includes 28.9% of men and 43% of women. Conversely, 28.2% do not use cassava sales for education, with 11.3% being men and 16.9% women (Figure 8c). In the East

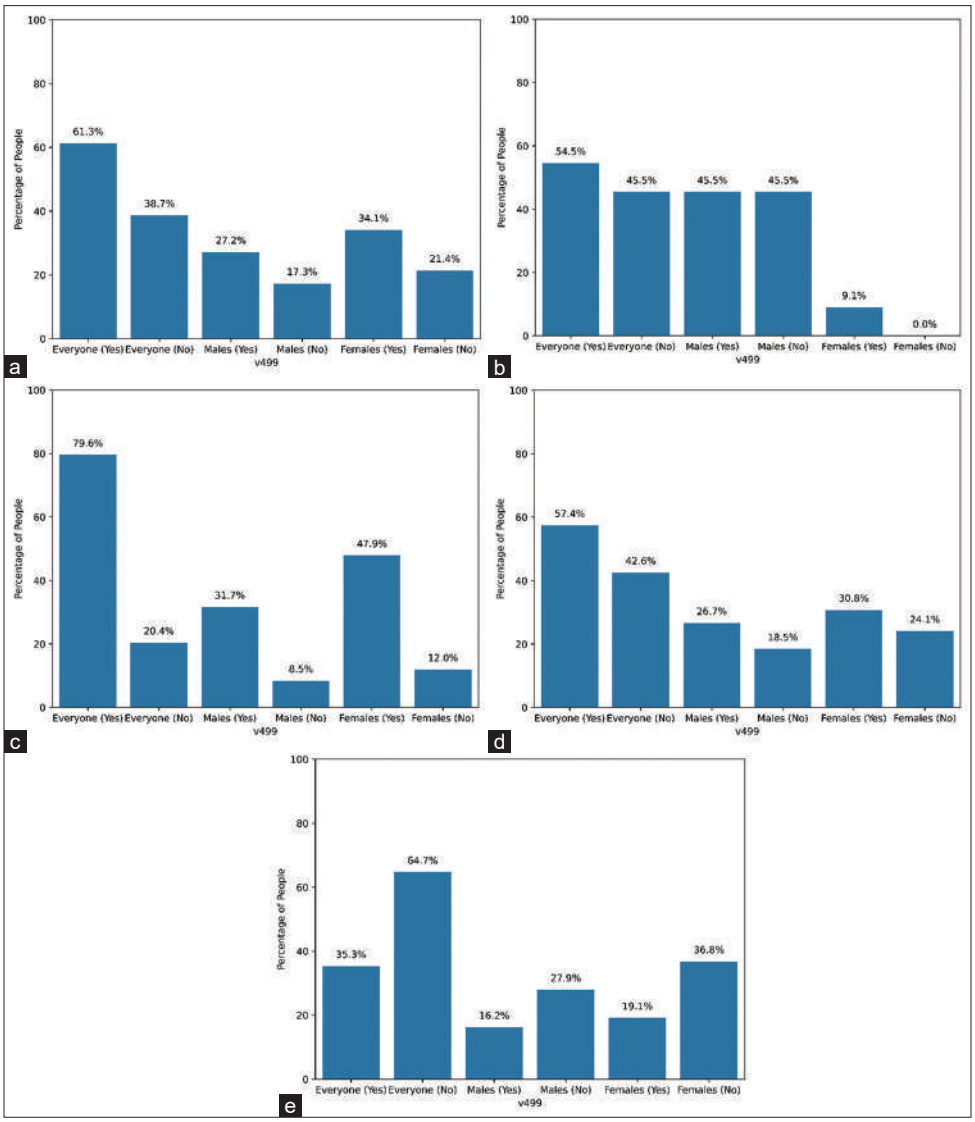

Figure 7: Within-household contribution of income generated from Cassava sales to health needs. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

region, 56.9% of cassava farmers (26.7% men and 30.3% women) believe that income from cassava sales helps cover schooling needs. Among those who disagree (43.1%), 18.5% are male, and 24.6% are female (Figure 8d). Finally, in the South region, 25% of cassava farmers (14.7% men and 14.7% women) acknowledge that cassava sales contribute to their household's schooling needs. However, 75% of cassava farmers (29.4% men and 45.6% women) disagree (Figure 8e).

Participation in community activities

Upon initial examination, figure 9a shows that 56% of all surveyed cassava farmers actively participate in community activities. Among these, 24% are men, and 32% are women. For those not involved, 44% of cassava farmers fall into two categories: 20.4% are male, and 23.6% are female. In the Adamawa region, only 9.1% of cassava (all men) engage in community activities, while 90.1% do not. Among the non-participants, the majority (81.8%) are men, with a smaller proportion (9.1%) being women (Figure 9b). Contrastingly, in the Center region (Figure 9c), the trend is reversed. Here, 93% of cassava farmers actively participate in community activities, comprising 37.3% men and 55.6% women. Only 7% of cassava farmers abstain from community involvement, with 2.8% being men and 4.2% women. In the East region (Figure 9d), the percentages are nearly identical. Those who refrain from community activities constitute 50.8%, divided into 22.1% men and 28.7% women. Meanwhile, 49.2% actively participate, including 23.1% men and 26.2% women. Figure 9e sheds light on the South region, where 5.9% of cassava farmers participate in community activities (1.5% men and 4.4% women). Conversely, a significant proportion of cassava farmers opt out of community engagement: 42.6% of men and 51.5% of women.

Acquisition of assets with accumulated income generated from Cassava sales over the last 5 years

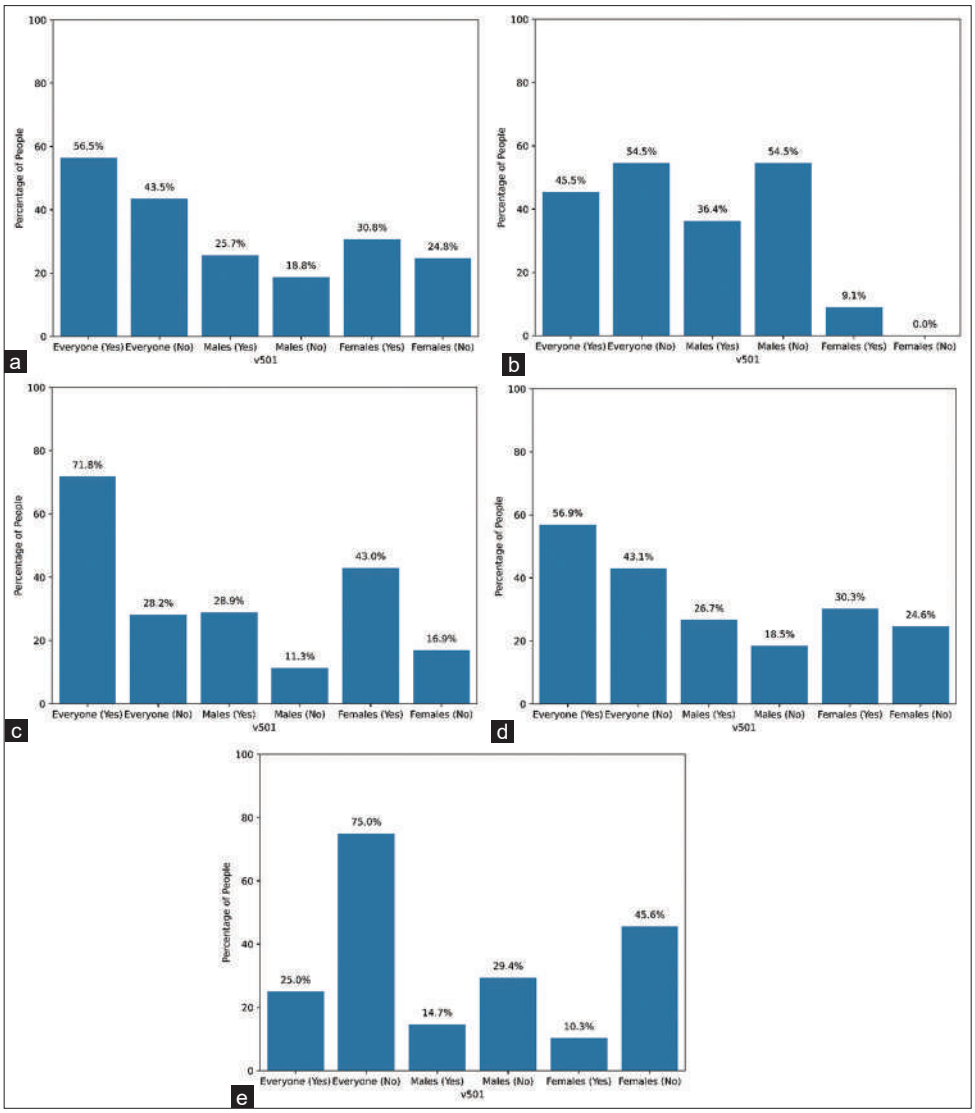

Figure 8: Within-household contribution of income generated from Cassava sales to schooling needs. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

The overall data indicates that only 37.5% of cassava farmers have acquired assets from cassava, comprising 15.1% men and 22.4% women. Conversely, 62.5% have not acquired any assets, with 29.3% being men and 33.2% women (Figure 10a). In the Adamawa region, only 18.2% of cassava farmers (all men) have acquired assets from cassava over the past five years. In contrast, 81.8% (72.7% men and 9.1% women) have not (Figure 10b). Figure 10b reveals that very few cassava farmers recall acquiring assets from their cassava-related activities. Two possible interpretations emerge: either cassava-related activities do not significantly benefit farmers, or the expenses incurred by cassava farmers whose income is derived from cassava-offset any asset acquisition. In the Centre region, 50% of farmers on both sides of the divide are cassava farmers. Among those who answered affirmatively, 20.4% were male, and 29.6% were female. Conversely, among those who answered negatively, 19.7% were men, and 30.3% were women (Figure 10c). In the East region, 62.1% of cassava farmers (30.8% male, 31.3% female) have not acquired any assets from cassava income in the last five years. Only 37.9% (14.4% male, 23.6% female) have done so (Figure 10d). Finally, Figure 10e highlights that only a small proportion (13.2%) of cassava farmers comprising 5.9% men and 7.4% women have acquired assets. The majority (86.8%) have not, with 38.2% being men and 48.5% women.

Chi-Square Analysis of Categorical Variables

V31 is associated with V48 based on a p-value of 0.0026 (Figure 11a). This result is highly significant. Smartphones play a crucial role in agriculture. For cassava farmers, this implies that they must possess reading and writing skills to effectively use relevant applications. These applications would help them identify diseases affecting cassava production and get treatment advice, ultimately maximizing yields. Also, V31 is strongly associated with V49 with a p-value of 1.1e-05. Again, this result is highly significant. Internet connectivity is essential for

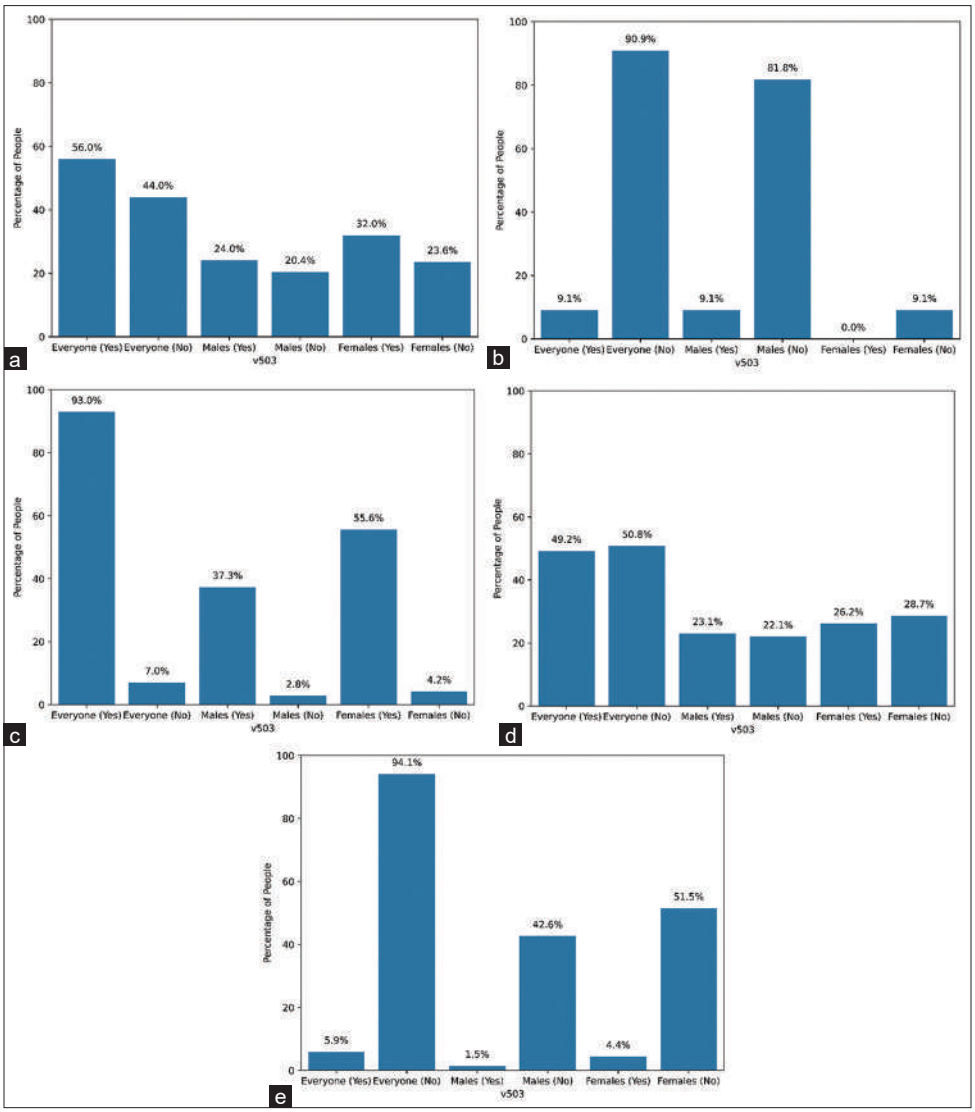

Figure 9: Participation in community activities. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

personal farmer training and collegial training among farmers. Non-governmental Organizations financing farmers' projects rely on this connection for effective communication, reporting, and addressing specific needs expressed by the farmers. Variables V48 and V49 are highly associated (p-value=1.2e-70), indicating strong co-dependence (Figure 11a).

In Figure 11b, variables V31 and V48 are not associated (p-value=1). Consequently, the result is not significant. The data in Figure 11b diverges from the general trend observed in Figure 11a. This discrepancy can be attributed to the prevalent illiteracy among cassava farmers in the Adamawa region, as well as among women in the northern part of Cameroon. Similarly, variables V31 and V49 exhibit no association, with a p-value of 0.71. Consequently, these variables are independent (Figure 11b). The underlying reason is the low level of education among cassava farmers (both men and women) in the northern part of Cameroon. V48 and V49 lack association, resulting in high independence (p-value = 0.78, Figure 11b). The same holds true for variables V48 and V503, where the p-value is 1, rendering the result insignificant (Figure 11b).

In Figure 11c, V31 and V48 are not associated (p-value=0.82). Consequently, the result is not significant. Similarly, V31 and V49 are not associated (p-value=0.61), indicating their independence. V31 and V325 are also not associated (p-value=1). On the other hand, V48 and V49 exhibit near perfect association, making them highly dependent due to the significance threshold of 7e-22. Consequently, the result is highly significant. However, V48 and V503 are not associated (p-value=0.57), indicating their independence. Furthermore, V325 and V495 are not associated (p-value=0.34. These variables are highly independent. Finally, V495 and V497 are associated (p-value=1e-05), indicating dependence.

In Figure 11d, variables V31 and V48 are associated with a

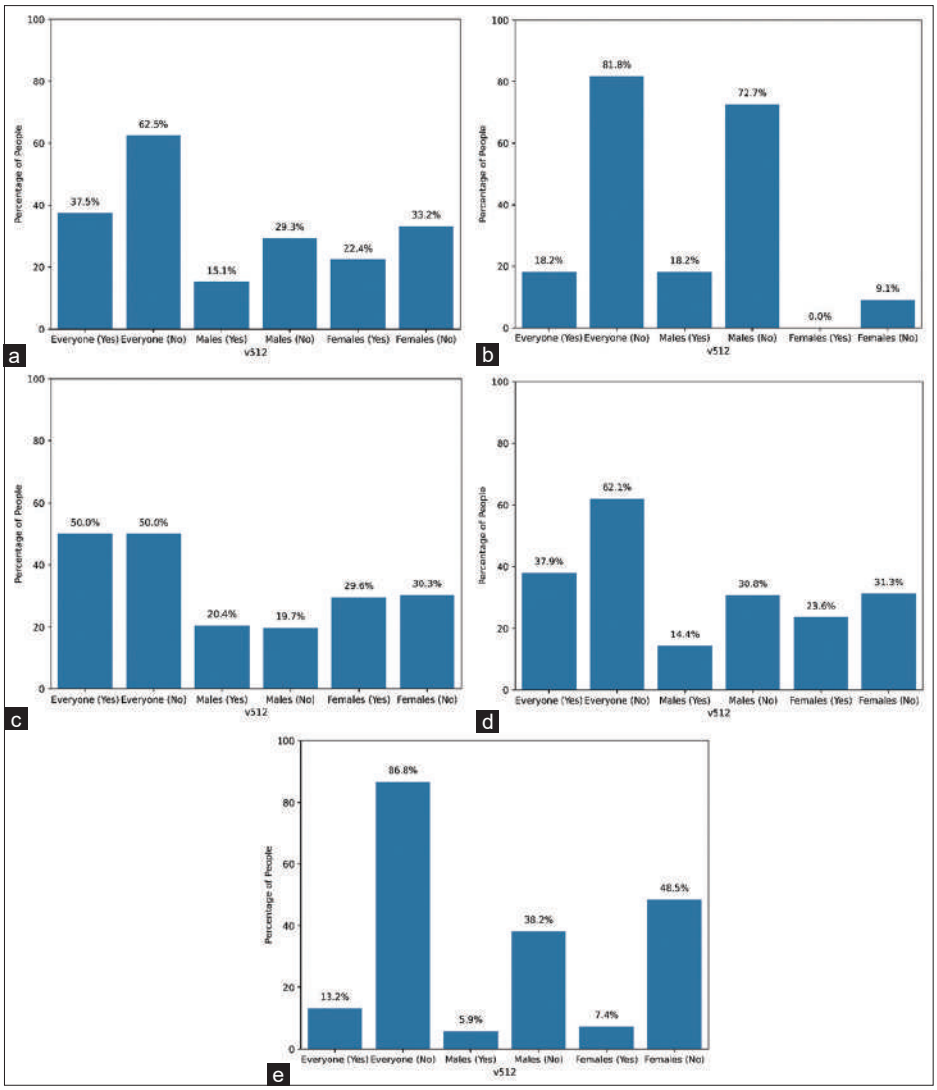

Figure 10: Acquisition of assets with accumulated income generated from Cassava sales over the last 5 years. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Regio

Table 2: Descriptive Statistics – total and per region

Variable	Mean	Median	Range	
v28	42.2	41	75	Country wide
v41	4.2	3	21	
v72	12	6	100	
v82	108	1	9000	
v28	47.2	42	28	Adamawa
v41	6.6	7	11	
v72	17	5	69	
v82	3.2	2.5	9	
v28	46.9	49	44	Center
v41	4.3	3	21	
v72	13.9	11	50	
v82	260.4	1	9000	
v28	39.6	38	60	East
v41	4.6	4	15	
v72	11	6	99.5	
v82	40.2	1	5000	
v28	39.1	33	75	South
v41	2.8	2	14	
v72	9.9	2.5	100	
v82	1.5	1	19.8	

p-value of 0.0054. This association is highly significant. Variable V31 is strongly associated with variable V49 (p-value=0.0013), indicating their dependence. Variables V31 and V325 are not associated (p-value=0.17). Consequently, they are independent. Variables V48 and V325 are also not associated (p-value=1), indicating independence. Variables V48 and V49 exhibit strong association (p-value=2e-37), making them highly dependent. Variables V48 and V503 are strongly associated (p-value=0.0052), indicating dependence. Variables V325 and V495 are associated (p-value=0.023). The Chi-square test between variables V495 and V497 establishes a highly significant interaction (p-value=1.9e-08).

In Figure 11e, variables V31 and V48 are not associated (p-value=1), suggesting independence. Similarly, variable V31 is not associated with variable V49 (p-value=0.63). Variables V48 and V49 on the other hand exhibit strong association (p-value=3e-12), making them highly co-dependent. Variables V48 and V325 are not associated (p-value=0.67). Variables

Figure 11: Association heatmap-based matrices for qualitative variables. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

V48 and V503 are also not associated (p-value=1), suggesting independence. Variables V325 and V495 are not associated (p-value=0.2). However, variables V495 and V497 are strongly associated (p-value=1.9e-08), indicating a highly significant co-dependency.

Descriptive Statistics for Quantitative Variables

Table 2 details the values of the descriptive statistics for each quantitative variable at all 5 geographical resolutions. Data from the Center and East regions influenced the country-wide values more than data from the Adamawa and South regions.

Correlation Analysis of Quantitative Variables

In Figure 12a which covers all four regions of the study in Cameroon, an intermediate positive correlation is observed (r=0.3) between two variables: V28 (representing age) and V41 (indicating the number of household members involved in agriculture). This suggests a moderate positive relationship between these two factors. For the Adamawa region (Figure 12b), the correlation between V28 and V41 is notably strong (r=0.73). This implies a robust relationship between the age of Cassava farmers (V28) and the level of household involvement in agriculture (V41). In the Center region (Figure 12c), the same analysis was conducted for the

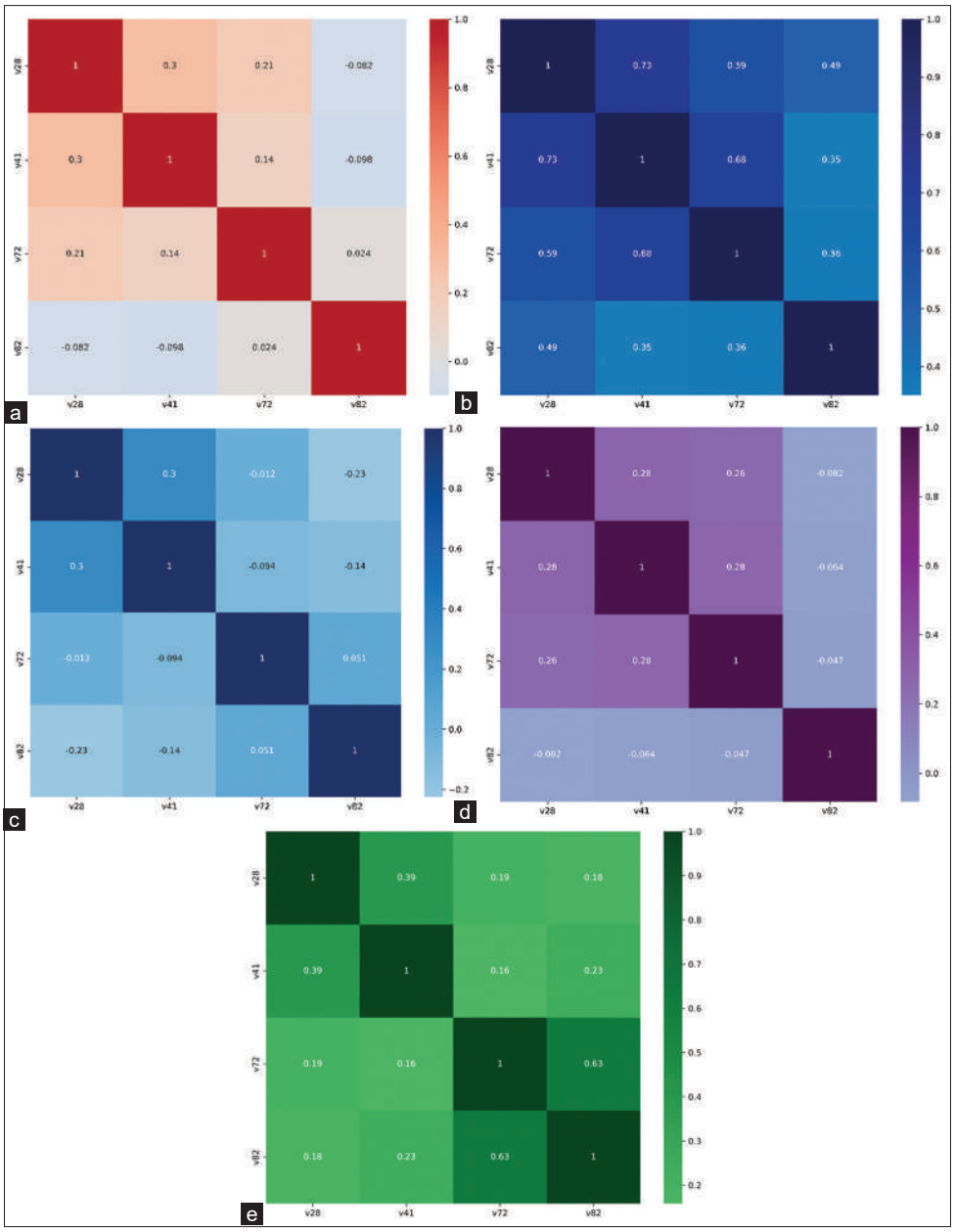

Figure 12: Correlation heatmaps for quantitative variables. a) General Results, b) Adamawa Region, c) Center Region, d) East Region and e) South Region

variables V28 and V41. The results revealed a moderate positive correlation (r=0.3) between these two variables. Therefore, a moderate positive relationship exists between the age of Cassava farmers and the level of household involvement in agriculture in the Center region of Cameroon. The observed correlation can be interpreted as follows: As the number of household members engaged in agriculture increases, the average age of Cassava farmers tends to be higher. This suggests that families with greater agricultural experience (represented by older age) are more likely to have multiple members actively participating in this activity (Figure 12c). Now, turning to the East region (Figure 12d), the analysis for the same variables (V28 and V41) reveals a weak positive correlation (r=0.28), indicating a subtle positive relationship between these variables. In the South region (Figure 12e), the same analysis was conducted using V28 and V41. The observed positive correlation was weak (r=0.39), signifying a subtle positive relationship between these variables.

CONCLUSION

This study highlights the comparative lack of access to internet services, smart phones and land-related resources among farmers in the Adamawa and East regions of Cameroon – resources which can help them connect to the world and get exposed to current information on improving their farming potentials, leading to improved livelihoods. The authors recommend that the Adamawa and East regions of Cameroon be marked as priority regions for modernization of root and tuber farming.

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