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Quantitative Analysis of Cassava Products and Their Impacts on the Livelihood of Value Chain Actors: Case of the Centre Region of Cameroon

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Authors' contributions

This work was carried out in collaboration between all authors. Author FTF performed the data collection, the statistical analysis, managed the literature searches and wrote the first draft of the manuscript. Author CNT managed the literature searches and corrected the draft manuscript. Author FAN designed the study, elaborated the research protocol, facilitated the work and corrected the draft manuscript. All authors read and approved the final manuscript.

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ABSTRACT

This study was carried out to analyze the trend of cassava (*Manihot esculenta*) products and impacts on the livelihood of value chain actors in the Centre Region of Cameroon. Thus, surveys were carried out in 2016, in six localities (Yaounde, Bafia, Obala, Ngoumou, Mbankomo and Mbalmayo) of the Centre Region with the aid of structured questionnaires. Three hundred value chain actors mainly producers, processors, transporters, marketers and consumers of cassava and cassava-based products were selected through a multi-stage random sampling technique and interviewed in markets. However, some producers and consumers were interviewed in their farms,

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restaurants and at home. Data collected were analyzed using IBM SPSS 20. The results indicated that different cassava products were available at different levels of the value chain. Bobolo/baton, flours, tubers, cassava leaves, cassava cuttings, starch, mitoumba/mintoumba/ntoumba, garri/gari, and water fufu were the main products sold. Meanwhile, tubers, bobolo, leaves and flour were observed as the most consumed products. About 87% of producers had farm sizes ranging from 1-5 Ha and 13% had farms greater than 5 Ha. The main sources of planting material were from neighboring farms (65%), friends (19%), seed farms (9%) and donations (7%). Approximately 90% of plant material used were local cassava varieties and 10% were improved varieties. The main difficulties encountered in cassava production were infertile soils (15.73%), unavailability of quality seeds (14.61%), pests and diseases (12.36%) and the remainder were other constraints. At the marketing level, constraints such as poor transport facilities (31.51%), scarcity of conservation or storage facilities (19.18%), price fluctuations (16.44%) and poor marketing channels (15.07%) were noted among others. In the transformation sector, difficulties registered were, poor mechanization, poor transport facilities, scarcity of fuel wood and raw material. Thus, mechanization is recommended to enhance the productivity and competitiveness of the cassava value chain in the region.

Keywords: Cassava products; cuttings; local and improved varieties, Manihot esculenta; mechanization.

1. INTRODUCTION

Cassava is one of the most important basic food crops grown in Africa [1]. The crop plays a major role in efforts to eradicate famine in Africa because of its high starch content, tolerance to poor soil conditions and drought, year-round availability, and suitability for diverse smallholder farming systems [2]. In Cameroon, Cassava is one of the most important food and cash crops. It is grown in all the five (05) agro-ecological zones of the country [3-5]. The annual production of cassava roots in 2014 was 4 917 544 tons [3]. 80% of the production came from the humid forest zone of the country [6]. Cameroon's economy remains highly dependent on its agricultural sector which currently employs more than 68% of the national active labor force, significantly contributes to GDP (Gross Domestic Product), and provides 15% of public budget. Since the early 80s, urbanization has induced increases in the demand for food crops to which local supply has been rather insufficient [7]. Many constraints such as seed quality, the decline in soil fertility, poor agricultural practices and techniques, but especially pests and diseases [8] which has as major consequence a reduction in production, eventually lead to the rise in market prices. Since the late 1980, Cameroon has recorded an increase in prices of the different cassava derived products in the urban markets [6,9]. Demographic projections predict a rise in the world population and this increase in population growth far surpasses that of agricultural production. In spite of being a major driver of Cameroon's food security, the

cassava value chain has to cope with several challenges and constraints in terms of production, processing, and marketing, and with regards to stakeholder organization(s) and financial institutions. These constraints severely impede income generation and the overall value chain development process. Several opportunities however exist and several options such as trend analysis can be envisaged to overcome those constraints and entail a more intensive and inclusive development process.

A trend is a pattern of gradual change in a condition, output, or process, or an average or general tendency of a series of data points to move in a certain direction over time, represented by a line or curve on a graph [10]. A trend analysis is a method of analysis that allows the trader to predict what will happen with a stock in the future. Trend analysis is based on historical data about the stock performance given the overall trend of the market and particular indicators within the market [11]. It is aimed at projecting both current and future movements of events through use of time series data analysis which involves comparison of data over sequential periods of time to spot the pattern or trend [12]. Besides livelihood comprises the capabilities, assets, and activities required to earn a living. A livelihood is "sustainable" when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets, both now and in the future, while not undermining the natural resource base [13]. On its part, a value chain refers to the full life cycle of a product or process, including material sourcing,

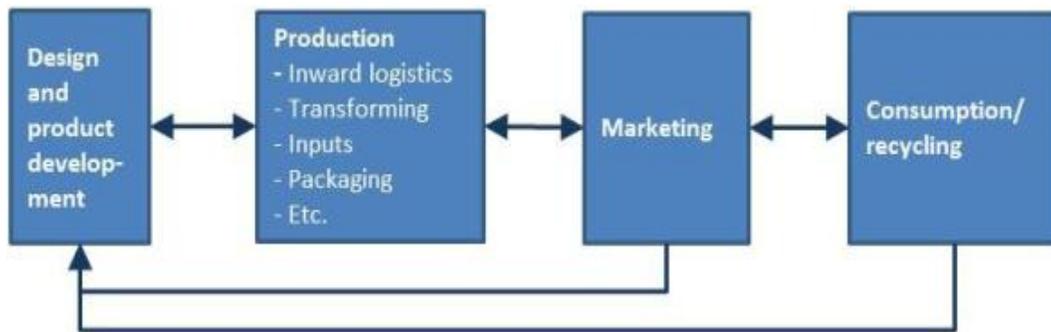


Fig. 1. Four links in a simple value chain [15]

production, consumption and disposal/recycling processes [14]. It describes the full range of activities that firms and workers do to bring a product from its conception to its end use and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer (Fig. 1) [15]. The activities that comprise a value chain can be contained within a single firm or divided among different firms. Value chain activities can produce goods or services, and can be contained within a single geographical location or spread over wider areas [16].

The goal of this research was to demonstrate the importance of cassava and its by-products, contribute to the understanding of the drawbacks that impede the competitiveness of the value chain and impact on the livelihood of the population of the Centre Region. More specifically, it was to identify the different cassava products at the different levels of the production chain; assess the quantities of each product that was made available; determine the different uses of cassava and by-products; identify major constraints at different levels of the production chain and propose possible solutions and to determine the various consumption patterns of cassava products.

2. EXPERIMENTAL DETAILS

2.1 Study Area

The study was realized in six (6) localities (Yaounde, Bafia, Obala, Ngoumou, Mbankomo and Mbalmayo) of the Centre Region of Cameroon (Fig. 2). These localities were chosen because they are areas of high cassava production, transformation, sales and consumption. Additionally, the localities represent the main divisions of the Centre Region and are close to IRAD (Institute of

Agricultural Research for Development) Nkolbisson (Yaounde), which facilitated data collection. The study area is characterized by a bimodal rainfall pattern, with four seasons: Long rainy season from September to November, long dry season from December to February, short rainy season from March to June and short dry season from July to August [17]. The average daily air temperature varies from 23 to 24°C and a rainfall of 1,500-2,000 mm per year. It extends over most of the South-Cameroonian plateau between 500 and 1,000 m altitude [17]. The people here are the Bantu group known as the Beti-Pahuin (Béti-Pahouin), the "Fang-Beti," or simply the "Fang".

2.2 Data Collection

Data collection was done with the aid of structured questionnaires. Value chain actors mainly producers, processors, transporters, marketers and consumers of cassava and its derived products were interviewed. The different actors were generally met in the markets on the market days, in farms, restaurants and at home. Interviews were done mostly on market days to capture a wide diversity of the value chain actors particularly in the morning when these actors were more available and willing to respond to the questions. Data on the different cassava products, their quantities, uses, the different constraints faced by actors and the various consumption patterns were obtained. Given the social dimension of this study, the determination of the people to be interviewed was done randomly. Multi-stage random sampling techniques (Primary Unit: the localities; Secondary Unit: level of value chain; and Tertiary Unit: the actors of the value chain) was used to select a total of three hundred (300) individuals interviewed, approximately 50 individuals in each locality.

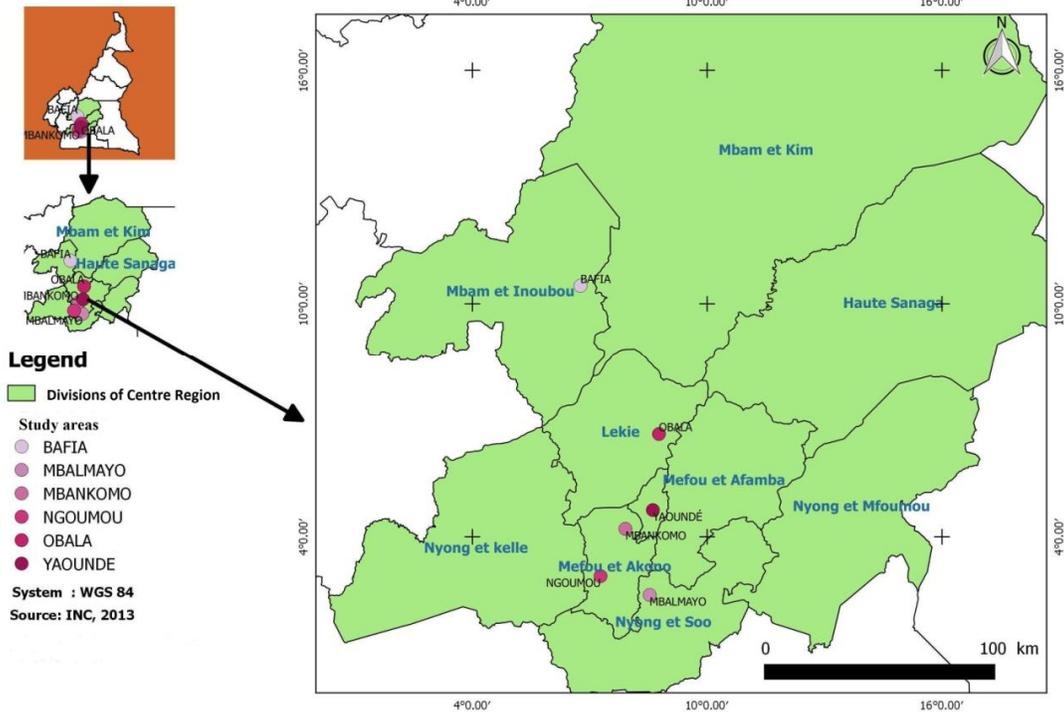


Fig. 2. Study areas

2.3 Data Analysis

The data collected were coded, entered into a Microsoft Software Excel spreadsheet and analyzed using IBM SPSS (Statistical Package for Social Scientists) Statistics 20th version software. The analysis of primary data collected permitted evaluation of the relative quantities of cassava and cassava-based products, produced and sold as well as identification of major constraints in the value chain.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Production levels

In Cameroon, cassava can be found in various forms with a wide range of consumption options. The various cassava by-products that can be found on the territory are the following: Couscous (fufu), fresh couscous (water fufu), Mitoumba/Mitumba/Ntoumba (Cameroonian cassava-based dish made with palm oil, salt and pepper), bobolo/baton (Cameroonian dish made from cassava in the form of a fermented root pounded, wrapped in a stick-shaped leaf and steamed), cassava donuts, ndas (Cameroonian

dish), konda (Cameroonian dish), chips (cossettes), flour, starch, garri/gari (popular West and Central African food made from cassava tubers), alcohol and mbom kwem (Cameroonian dish). At the different levels of the cassava value chain different products were observed and noted. At the level of production, the main products observed were cassava tubers (46%), bobolo (27%), cassava leaves (20%), mitoumba (3%), flour (1%), starch (1%), and cuttings (1%) as shown in the Fig. 3. As it can be observed at this level of production of the value chain, cassava roots, bobolo and cassava leaves were the dominant products (Figs. 3 and 4).

3.1.2 Marketing levels

At the marketing level of the value chain, more products were observed compared to those produced in the zone due to the supply from neighboring regions notably North West, West, Littoral and South West Regions of Cameroon. Cassava-based products mainly garri and water fufu added to the list of cassava products identified at this level. Bobolo (34%) was the most common product followed by roots (33%), leaves (14%), flour (10%), water fufu (3%), mitoumba (2%), garri (2%), starch (1%) and cuttings (1%) (Fig. 5).

3.1.3 Consumption levels

At the consumption level of the value chain, products such as roots (19%), bobolo (18%),

cassava leaves (17%), flour (14%), garri (12%), water fufu (10%), mitoumba (9%), and mbokwa (cassava donuts) (1%) were noted (Fig. 6).

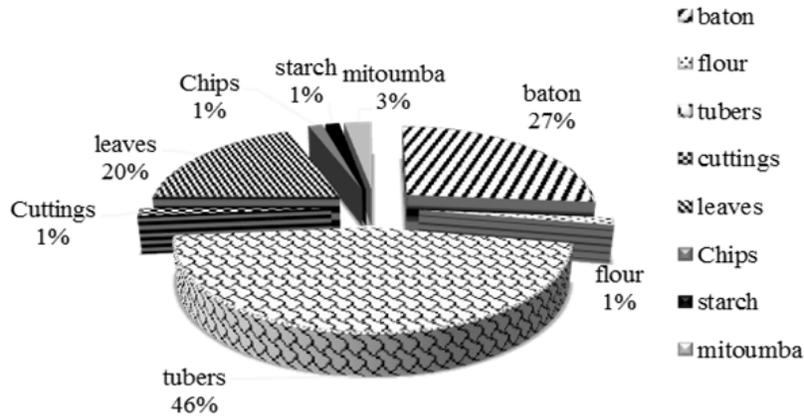


Fig. 1. Main cassava products at the production stage of the value chain



Fig. 4. Main cassava products

a: Bobolo (baton), b: Flour, c: Mintoumba, d: Cossettes (dry), e: Gari/garri, f: Donuts, g: Chips (fresh cossettes fries), h: Liquid starch, i: Starch powder, j: leaves, k: Water fufu (to make fresh couscous), l: Biscuits, m: Cuttings and tubers

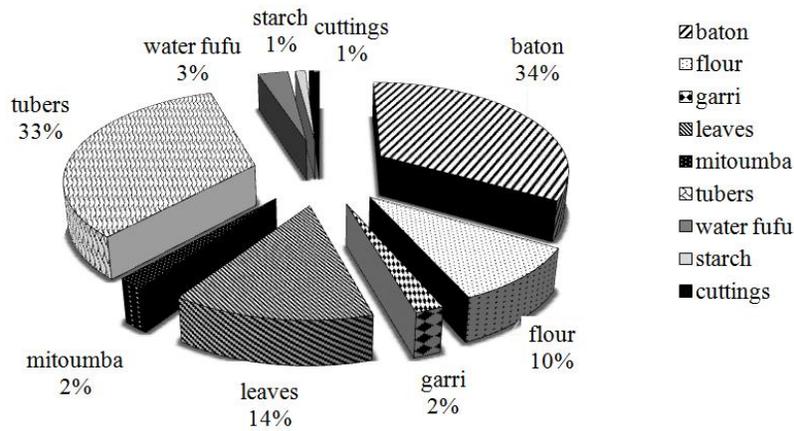


Fig. 5. Main cassava products at the marketing level of the value chain

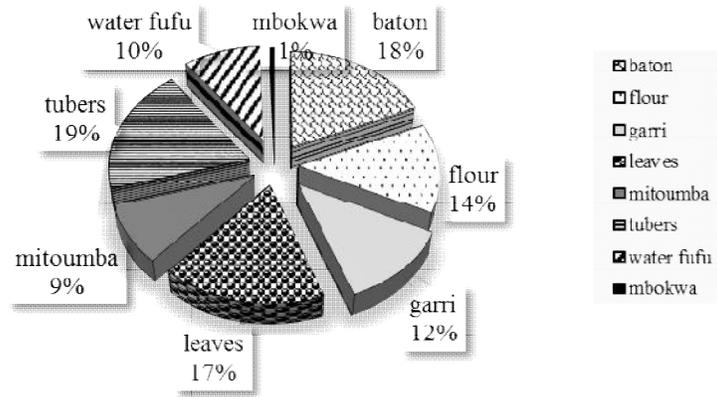


Fig. 6. Main cassava products at the consumption level of the value chain

3.1.4 Farm management

The farming tools were cutlasses and hoes. The cultivated fields were small farms of sizes <1 Ha (65%) and the activity was mostly done by women. There were also medium farms of sizes approximately 5 Ha (25%), and community farms of sizes > 5 Ha (10%). Farm sizes, equipment used, planting material, soil fertility and farm yield were parameters that were used to estimate the quantity of cassava and cassava-based products produced.

Thus, the quantity of cassava product produced in the humid forest agro-ecological zone was deduced from the general farm sizes of the producers and the variety of cassava they used. Fig. 7 presents the percentage distribution of farm sizes.

Farm productivity (yield per hectare) depended on factors such as quality of planting material

and soil fertility. It was observed that planting material (cuttings) were generally obtained from neighboring cassava farms (65%), friends (19%) and small quantities from cassava seed farms (9%) and other sources such as donations from the Government or NGOs (7%) as observed in Fig. 8.

The main variety of cassava (Fig. 9) produced in the humid forest zone of Cameroon were local varieties (90%) compared to improved varieties (10%) such as 8034, 8017, 92/0326, 96/1414 and TME 419. These varieties are resistant to major pests and diseases, high-yielding (30 to 40 tons per hectare) and are multipurpose.

At the end of the study it was realized that a majority of producers did not use fertilizers in their cassava farms to ameliorate the soil quality, which is possibly responsible for the gradual decline in farm productivity observed with time.

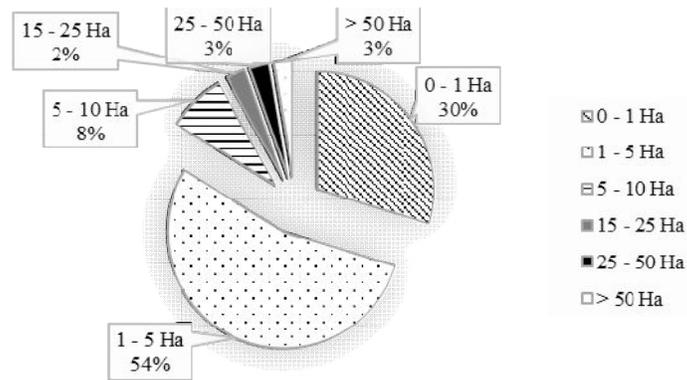


Fig. 7. General farm size disposition

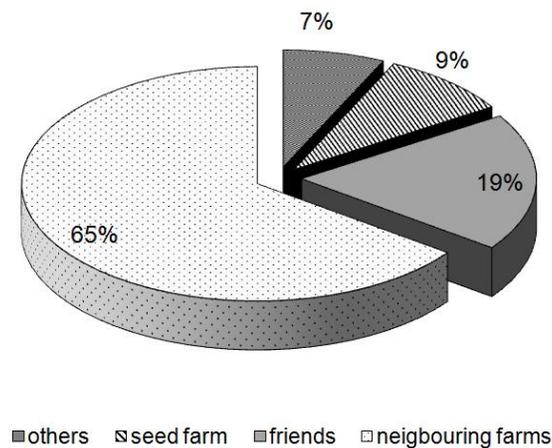


Fig. 8. General source of cassava cuttings

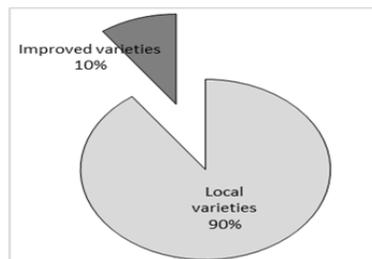


Fig. 9. Different varieties of cassava produced

It was also observed that cassava products are highly consumed in the study area, particularly tubers (19.03%), bobolo (18.48%), leaves (17.39%), flour and chips (13.59%) as shown in Fig. 12.

Roots, leaves and bobolo were the most consumed cassava products on a weekly basis in the tropical humid zone of Cameroon (Fig. 13).

3.1.5 Production goal and uses

The goal of producing cassava was largely for consumption (subsistence) (37%), trade (market) (36%) and transformation (20%), as well as other goals such as the creation of seed farms for the selling of cuttings (1%), and exportation of products (6%) as indicated in Fig. 10.

Fig. 11 indicates the variation in cassava use in the value chain mainly at the production and marketing levels.

3.1.6 Constraints and main difficulties

Physical constraints observed were poor roads and infrastructure, lack of storage facilities and other infrastructures. Other constraints included lack of credit and financial services, lack of access to inputs and other agricultural technologies, lack of organizational support, lack of skills and knowledge on new technology that would increase their production, poor knowledge of market requirements such as quality, health and safety standards. In addition, some political

constraints were noted, particularly red tape and overly restrictive legal frameworks; excessive licensing requirements; poor legal framework to support farmers such as contract enforcement and trade policies that distort the real exchange rate, turning the terms of trade against agriculture.

At the level of production, the main difficulties encountered were soil infertility (15.73%), insufficient seed production (14.61%), pests

(insects) and diseases (12.36%) with minor constraints such as limited farm sizes, weeds infestation and insufficient farming tools (Fig. 14).

At the marketing level, the main constraint identified fall mostly under capacity and political constraints such as transport (31.51%), conservation of products (19.18%), price fluctuations (16.44%) and marketing (15.07%) (Fig. 15).

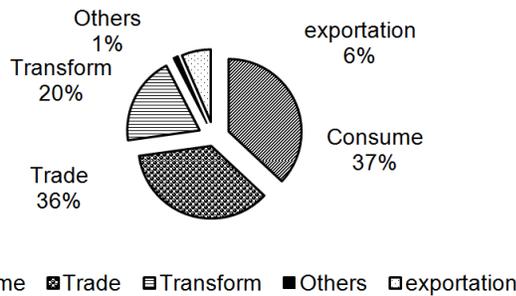


Fig. 10. Cassava production goals

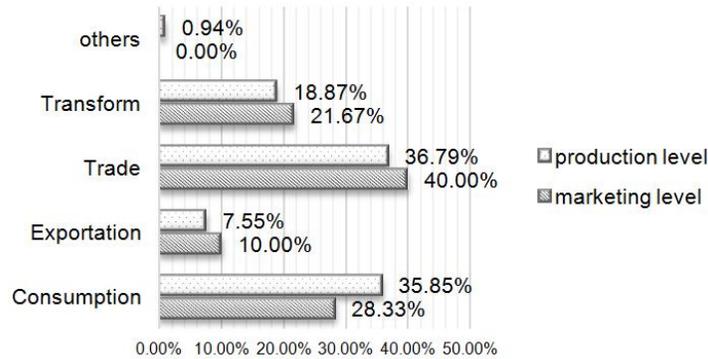


Fig. 11. Different uses of cassava products in the value chain

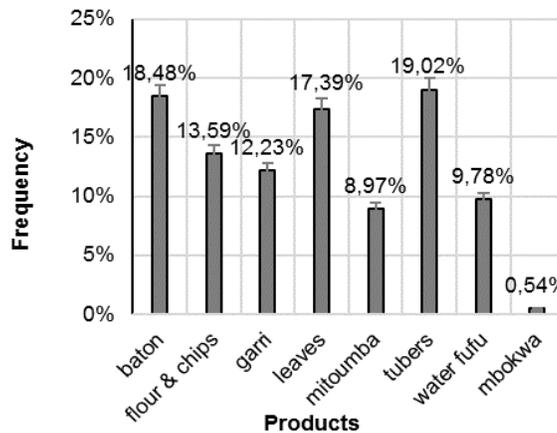


Fig. 12. Consumption distribution of cassava products

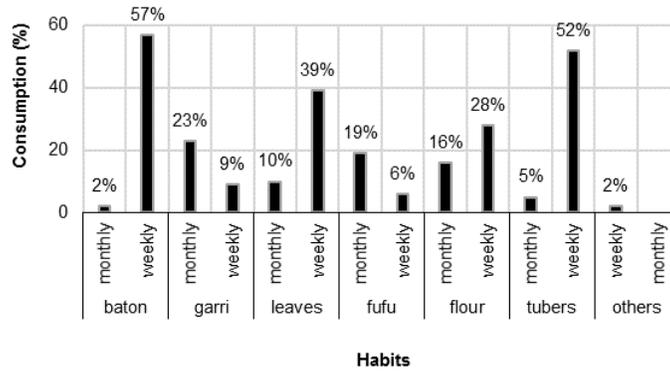


Fig. 13. Consumption habits (frequency of consumption)

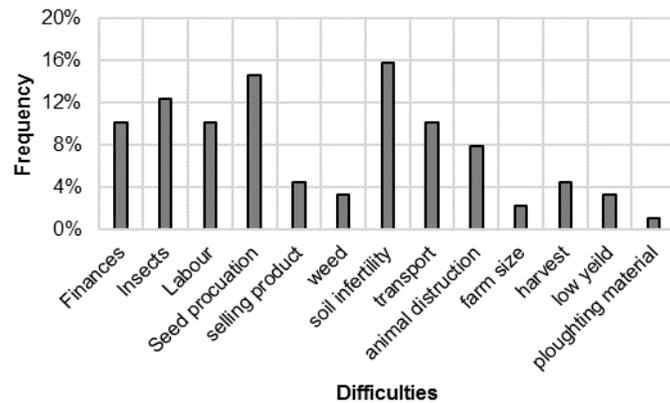


Fig. 14. Production difficulties in the cassava value chain

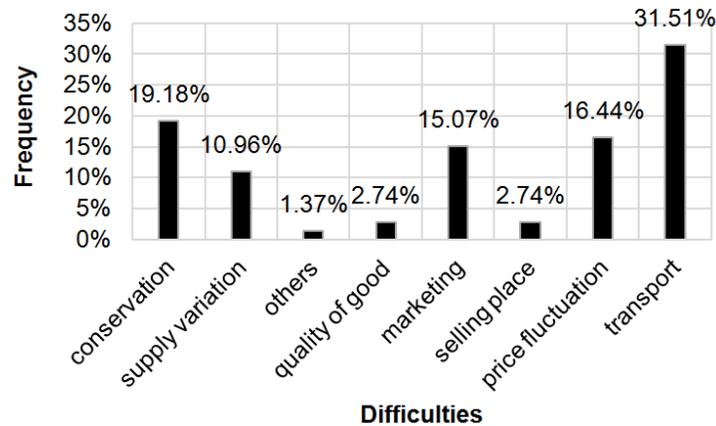


Fig. 15. Marketing difficulties in the cassava value chain

The transformation sector of the cassava value chain also faces similar problems of capacity and physical constraints similar to the production sector. The major difficulties (Fig. 16) were the strenuous activities (33.33%) which resulted mainly from the lack of mechanization (23.33%).

Other difficulties such as the transportation of material from the farms to the processing units and processed products to the markets; The limited availability of fuel wood for the processing of products and the scarcity of raw material were recorded (Fig. 16).

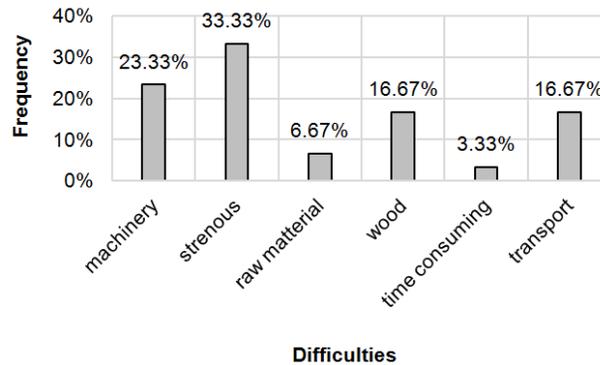


Fig. 16. Transformation difficulties in the cassava value chain

3.2 Discussion

Studies have been conducted on the cassava value chain [18-20]. But to our knowledge, few studies have identified the by-products at each level (production, transformation, marketing, consumption) of the value chain in the Centre Region. Thus, apart from the tubers found as the main by-products at all levels in the value chain, great variability was observed for the other by-products depending on the level of the value chain. Thus, cassava was found in various forms (Cassava roots, bobolo, cassava leaves etc.) with a wide range of consumption options in Cameroon at production level. At marketing level, bobolo (34%) was the most common product followed by tubers (33%), leaves (14%), flour (10%), water fufu (3%), mitoumba and garri (2%), starch (1%) and cuttings (1%). Tubers (19%), bobolo (18%), cassava leaves (17%), flour (14%) and garri (12%) were the most common products found at the consumption level. According to several authors [18,20,21], garri is the most popular by-product (at the consumption level) of cassava. Overall, the by-products identified in the cassava value chain were diversified and varied according to the habits and customs of populations, income level, farm size and production goal. Cassava products were highly consumed and the main products were tubers (19.03%), baton (18.48%), leaves (17.39%), flour and chips (13.59%). It was observed that tubers, leaves and bobolo were the most consumed cassava products on a weekly basis in the tropical humid zone of Cameroon. The preferential weekly consumption of tubers and cassava leaves by the populations in the tropical humid zone of Cameroon is explained by the fact that these two by-products are directly consumed without prior processing. Indeed, the tubers are stripped, washed and boiled while the leaves are

washed, crushed and prepared in sauce with compliments such as salt and pepper. The third place of bobolo (baton) is explained by the fact that it requires little local infrastructures (leaves and strings of plants harvested) for its manufacture. According to Bidogezza et al. [22], cassava leaves are valued because they are not only grown for self-consumption, but also because of their high market demand and their yields higher returns.

It was observed that, the majority (87%) of the population had small farm sizes (1-5 Ha) and equipment were rudimentary. This result is similar to those of Oyebanji & Akwashiki [23] who noted that smallholders account for more than 80% of cassava production in Nigeria. In fact, in Sub-Saharan Africa, agriculture is still germinal. The farm size along with yield rate per hectare are among the least in the world. Lack of good planting materials and equipment, absence of mechanization and power, soil infertility and land pressure are classified among the most recorded constraints [24]. Local cassava varieties are the mostly used plant material in the humid forest zone of Cameroon. In effect, Temegne et al. [9] recorded about one hundred local varieties in the humid forest and guinea savannah agro-ecological zones of Cameroon. The number of local varieties could be more than ten times higher than that of improved varieties in this area. This low production of improved varieties of cassava compared to local varieties would also be due to low adoption of improved varieties by producers of the zone [25]. However, the nutritive properties [26], and pest and disease resistance of improved varieties of cassava such as 92/0326 and 96/1414 are significantly more important than those of local varieties and should be more produced than local varieties. Planting materials were generally obtained from

neighboring farms and friends (65% and 19% respectively) in the humid forest zone of Cameroon. This result corroborates those of Njukwe et al. [11] who found that own field followed by neighbors were the main sources of cassava planting material in south of Cameroon. This result underlined the fact that government extension services are not efficient in technology dissemination in the region. Zundel et al. [27] emphasized that the common exchange of planting materials among farmers could encourage the rapid and effective diffusion of new genetic material.

Few producers have as main goal of production the exportation of products (6%). In effect, Oyebanji & Akwashiki [23] noted that over 90% of cassava produced in Nigeria was consumed locally with less than 10% utilized for industrial purposes. In this study, the main uses of cassava by-products were mostly for consumption, trade, and transformation, and varied from one level of the value chain to another. Indeed, cassava performs five major roles namely; Famine reserve crops, rural food staple, cash crop for urban consumption, industrial raw materials and earner of foreign exchange [28]. Cassava is a very versatile commodity with numerous uses and by-products. Each component of the plant can be valuable to its cultivator. The leaves may be consumed as a vegetable, or cooked as a soup ingredient or dried and fed to livestock as a protein feed supplement. The stem is used for planting propagation and grafting. The roots are typically processed for human and industrial consumption [29]. Household consumption of cassava products is not possible without processing of cassava parts to finished products. Fresh cassava roots cannot be stored for long because they rot within 3-4 days of harvest. They are bulky with about 70% moisture content and roots and leaves contain varying amounts of cyanide which is toxic to humans and animals, while the raw cassava roots and uncooked leaves are not palatable [30].

Several production, marketing and processing constraints (soil infertility, insect, transport, conservation, strenuous etc.) were identified. The constraints faced by farmers could generally be summarized into the following [31]. The first two are related to supply side constraints; and the last to both supply and demand constraints. The major constraints limiting cassava production were scarcity and high cost of fertilizer, high cost of agrochemicals, and unavailability of research results to cassava farmers at the appropriate

time and inadequate extension services [32]. Low soil fertility was one of the main constraints of production. However, a majority of producers did not use any fertilizers in their cassava farms although Cameroonian soils as soils of sub-Saharan African countries are deficient in nutrients [5,33-36].

Some factors influenced the presentation and discussion of some results which were: (1) the non-access to industrial producers and transformers due to their absence in the localities which led to the concentration of most of the work on the local and non-mechanized transformers and producers. (2) Lack of prior research studies on trend analysis of cassava products to serve as reference, which resulted to a reduction in the amount of data obtained from literature review and to facilitate the appreciation of the main problem of this work.

4. CONCLUSION

The trend analysis of cassava products in the tropical humid forest zone of Cameroon has brought out the general tendencies and output of the cassava value chain and how it impacts the livelihood of the populations who depend mainly on cassava and its by-products for their livelihood directly or indirectly. The crop plays a major role in efforts to eradicate famine because of its high starch content, tolerance to poor soil conditions and drought, year-round availability, and suitability for diverse smallholder farming systems. Different cassava products such as bobolo, flour, chips, tubers, cuttings, leaves, starch, mintoumba, garri, water fufu, and mbokwa (donuts) were identified. The production of cassava was dominated by subsistence farming on small farms ranging from 0 -5 Ha. Most of the varieties used were local varieties, which were generally obtained from friends or neighbors. In addition, there were constraints such as poor soils, pests and diseases infestations, poor transport facilities, scarcity of labor, absence of conservation and storage facilities and little or no mechanization. All these contributed to the observed low productivity and competitiveness of the value chain in the region leading to scarcity of some cassava products at certain periods of the year. The price of cassava was observed to fluctuate from one market to another and during different periods of the year. This variability in price affected the commercialization of cassava and cassava based products. Thus, the development of appropriate and cost effective farm-level

production and processing technologies, the increase in synergy between value chain actors, the development of an appropriate market information system and large-scale dissemination of developed technologies are recommended for enhancing the productivity and competitiveness of the cassava value chain in the region. This will certainly contribute to the amelioration of the livelihoods of all cassava value chain actors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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