

Value chain analysis of baobab (*Adansonia digitata* L.) Fruits in Blue Nile State, Sudan

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ABSTRACT

Baobab tree (*Adansonia digitata* L.) is one of the underutilized indigenous tree species, baobab fruits might be an opportunity as an income source for rural communities in Sudan. The specific research questions were: (i) Who is participating in the market chain of baobab fruits; (ii) what are the activities, linkages and relations between the actors in the market chain of baobab fruits; (iii) what is the relationship between main actors of baobab market chain for baobab fruits; and (v) how do the benefits distribute between actors along market chain of baobab fruits?. Purposive sampling technique was applied to select the 54 baobab value chain actors including producers, village traders, retailers, wholesalers and consumers of baobab fruits. All selected actors were interviewed to collect information on fruits quantities and incomes generated. Additional information from a household survey, key informant interviews, focus group discussions, market surveys, direct observations, and literature review were used to identify strengths, weaknesses, opportunities and threats of the baobab business. The study results illustrated that the main actors of the baobab along the market value were producers or gatherers/collectors, village traders, retailers, wholesalers, and consumers. The study results also identified that the gross margins of the actors were 96.84%, 87.97%, 85.67% and 62.61% for the producers, wholesalers, village traders and retailers, respectively. The study concluded that baobab fruits local trade is very important for profits for all actors. Further investigations are needed on actors involved in baobab fruits trade especially local processors on big city and exporters to international markets.

1. Introduction

The baobab is a deciduous tree which belongs to the family Bombacaceae, which widely spread in the semi-arid regions of sub-Saharan Africa (SSA). Though, it is of central Africa origin (Sidibe et al., 1996). Three hundred traditional uses of the baobab were documented in Benin, Mali, and Senegal across 11 ethnic groups and four agro-ecological zones (Buchmann, 2010). The tree is valued by local communities provides food, emergency water and fiber. It has also medicinal uses (Chia et al., 2008). It has edible fruit, leaves and seeds. Fiber from the stringy inner bark provides items such as rope, thread, basket, nets, and snares, fishing lines, strings for musical instruments, and a paper stock tough enough for banknotes (Sidibe & Williams, 2002). The fruit is rich in nutrients, both the kernel and the pulp contain substantial quantities of calcium, potassium, magnesium and vitamin C (Osman, 2004). The leaves are rich in provitamin A, protein and minerals, in exacting iron (Sidibe & Williams, 2002; Osman, 2004; Chadare et al., 2008; Stadlmayr et al., 2013; Muthai et al., 2017; Lisa, 2019).

Recently, there has been an increased demand for non-timber forest products especially baobab products were growing not only in the local market but in international market like Europe and North America where the fruit pulp is promoted as an excellent food due to its nutritious features (Bennet, 2006). As reported by Gebauer et al. (2014), more than 300 baobab products were reported in Europe, and a future increasing demand can be expected. Adam et al. (2013) reported that in the Nuba Mountains of Sudan, found that the sales of baobab fruits reflected the highest earning activity and contributed to more than half of the annual household income of farmers. Additional, baobab products can also play an important role in empowering marginalized people (Venter and Witkowski, 2013), especially for women, who are mostly the ones trading baobab products (Buchmann et al., 2010). Surplus is sold by women at the local market to earn some cash income, which is often spent on children's clothing, food, or school fees. Local women know the types, quality, and prices of baobab fruit, seeds, and leaves on the local markets and can therefore make a conscious decision when, or if, to sell or to store the baobab surplus (Buchmann et al., 2010). Due to Shackleton et al. (2007) who stated an abstraction to local markets can result in diminished appreciation of their role in supporting livelihoods, which could potentially lead to further marginalization of the low-income groups, and especially women, involved. According to Venter and Witkowski (2013), urged while marketing baobab products can be an opportunity in places such as southern Africa, where the local demand for baobab product as a subsistence product has

diminished. Gebauer et al. (2002) urged that the fruits are sold in local markets and are an important source of cash income for the certain tribes living in Central and South Sudan.

In Blue Nile a state baobab fruit was harvested from wild tree within agroforestry system, reserved forest and home garden tree around homes. Several studies take emphasized the baobab as one of the most important native fruit trees, with considerable sdethno botanical importance, in Sudan (Bella et al., 2002; Gebauer et al., 2002a, b; El Tahir, 2004; El Tahir & Gebauer, 2004; Gebauer & Osman, 2004; Gurashiet al., 2014, 2017; Adam et al., 2012; Adam et al., 2013).

However, the baobab fruit commercialization is poorly developed in the Sudan in general and in specific in the Blue Nile state. In spite of the socio-economic importance of baobab in Sudan, there is lack of knowledge available on the value chain analysis of baobab fruits mainly in Blue Nile State of Sudan. Thus, this study wants to fill this gap in knowledge. Additionally, there is very little information available on the basic market functioning and actors involved and benefits distributed and market environment in the study area. Thus, the specific research questions were: (i) who is participating in the market chain of baobab fruits; (ii) what are the activities, linkages and relations between the actors in the market chain of baobab fruits; (iii) what is the relationship between main actors of baobab market chain; and (v) how do the benefits distribute between actors along market chain of baobab fruits?.

2. Materials and Methods

2.1. Study areas

This study was conducted in Blue Nile state locates between latitudes 10° and 13° North and longitude 33° and 36° East (Figure 1). It locates in the south east of Sudan border Sennar state, and shares an international border with Ethiopia and South Sudan. It has an area of 45,844 km² and approximately total population of 1,193,293. The study areas were selected because of the richness of baobab trees and active local trade in baobab fruits. The study area was intentionally selected due to the existence of a baobab population. The State depends mainly on agriculture and the area suitable for cultivation is 2.5 million Fadden. According to FAO (2016), reported that the state is awarded with huge natural resources in terms of agricultural, live stock and forest potentials and offers attractive investment opportunities. Its economic activity is based on agriculture and livestock and increasing mineral exploitation.

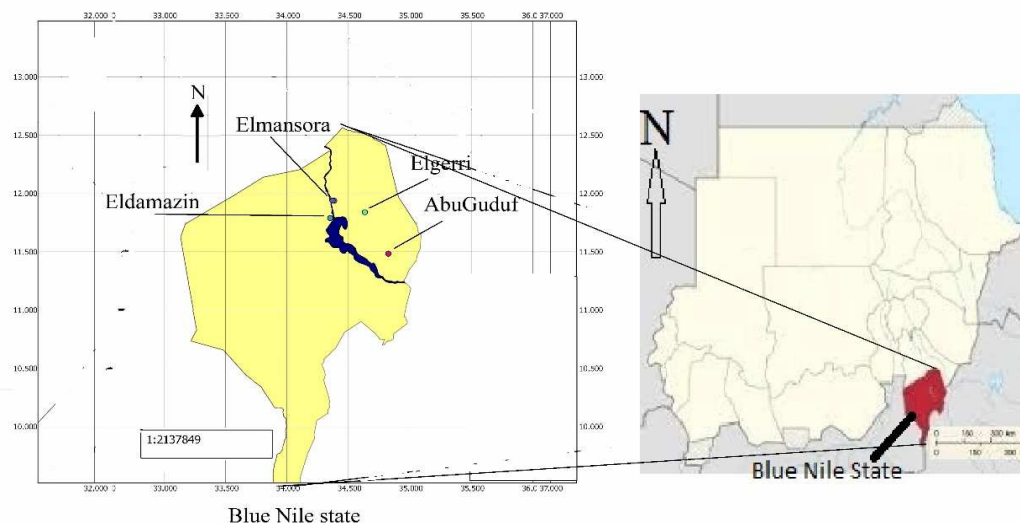


Figure 1. Study areas

2.2. Sampling and methods

Meanwhile this research firstly selected markets for baobab products in Blue Nile state, secondly collected secondary information about market actors which were involved in baobab marketing. Purposive sampling technics were used to select the actors and key informants. According to Tongco (2007) purposive sampling as one of the non-probability sampling is the most effective when researchers are studying a certain domain of the population with knowledgeable respondents within and it may be used in both qualitative and quantitative research techniques. The participants in this study included members of households who live and were in the village or in the local markets during the survey, officials, focus group discussions and key informant (KI) interviews, and final consumers. The actors were purposively selected to permit the collection of more in-depth and reliable data (Wollenberg, 2000). The survey covered information on baobab collection/harvest, sales data, procurement, processing, storage practices, quality requirements and bottlenecks among others. Moreover, data

for actors involved in baobab trade along the value chain and mapping out their relationships; data for the economic benefits earned by actors from baobab local trade along the value chain; and the institutional arrangements and institutions of baobab trade. In total, 30 producers, 7 village traders, 4 wholesalers, 4 retailers and 9 consumers were selected and interviewed.

To identify the involved actors in baobab local trade along the value chain and mapping out their relationships, individual/household were selected and interviewed in a one-to-one conversational manner which was directed along the lines of topics specific to this study. Interviews are the most important sources of data collection (Yin, 1994). A semi-structured questionnaire was developed and tested during the reconnaissance survey. Records of quantities in kilograms (Kgs), gram (gm) were registered. The collected data collection was included variable costs (SDG), buying and selling price (SDG) and revenues (SDG) generated per season by actors.

2.3. Data Analysis

Quantitative information was processed and analyzed by using Statistical Package for Social Sciences (SPSS) version 16.0 data sheet. Data from questionnaires coded and then entered into the data sheet for quantitative analysis. The next step was to run SPSS to analyze the data. The data presented in the form of descriptive statistics, tables, figures and charts. Qualitative data was reported and summarized to identify the actor types, establish relationship types, list of challenges met by actors along the chain, and examine the official arrangements.

2.4. Identification of the actors and their relationships

A value chain map was generated starting from the source of the products and following the products as they converted from raw materials to final products. The final map of the value chain was developed with participations from key informants, and then was further refined by supplementing detailed information derived from the responses to the in-depth semi-structured interviews with value chain actors and field observations (Ben Bennett, 2010).

2.5. Estimation of costs and margins along the value chain

The quantitative data regarding the variable costs, gross income, gross margins, value, cost benefit structures, value added, benefit distribution were estimated using the equation 1 below. Gross margin was calculated as an indicator for benefit distribution along the value chain. All data above was analyzed following steps in KIT and IIRR (2008). The production, marketing and processing costs in this study such as transport, accommodation, labor, collection, food, packaging, loading, taxes, market fee, storage, and others. Total revenue was calculated using the following equation:

$$\text{Gross margin} = \frac{\text{Revenue} - \text{total cost}}{\text{Revenue}} \times 100 \quad \text{equation (1)}$$

Total revenue was estimated using the following equation:

$$\text{Total revenue} = \text{Total quantity} \times \text{Unit price} \quad \text{equation (2)}$$

Gross income was calculated by deducting total variable costs from total revenues

$$\text{Gross income} = \text{Total revenue} - \text{Total variable cost} \quad \text{equation (3)}$$

Gross margin is the gross income per unit of produce estimated by following equation:

$$\text{Gross Margin (\%)} = \frac{\text{Gross income}}{\text{Total revenue}} \times 100 \quad \text{equation (4)}$$

The added value was estimated based on buying and selling prices. Added value is the amount of value that each actor in the chain adds. It is the difference between the price the actor pays for the produce. Added value along the chain was estimated using the following formula (Bockel & Tallec, 2005):

$$\text{Added value} = \text{Selling} - \text{Buying price} \quad \text{equation (5)}$$

3. Results and discussion

3.1. Value chain actors

The value chain survey for baobab fruits recognized many actors; producers, village traders, wholesalers, retailers and consumers as network for pulp impeded seeds (pulp/seed) (Table 1). Producers were men in majority. They represent 86.7% of the group. Since the baobab fruits production at Blue Nile State is seasonal, this activity is usually considered as secondary. Therefore, the producers were mainly farmers and/or employed. Producer actors were the most important in the chain for baobab fruits. Approximately most people at study

areas were involved in gathering of baobab fruits. According to study findings of this study, 100% of village traders, wholesalers and retailers were males. This may be due to the fact that males were more involved in baobab production and marketing activities than females, and thus have an excellent knowledge on baobab fruits trade.

Table 1. Activities, marketing channels and characteristics of the interviewed respondents (n=54) along the market chain

Value chain actors	n	Activity	Main marketing channel	Characteristics
Producers	30	•Harvesting. •Cracking fruits. •Packing	•Sell mostly at village market or weekly market	86.7% men 13.3% women
Village traders	7	•Buying from producers. •Selling to wholesalers. •Transport fruits to markets	•Selling mostly town markets •Buy pulp/seeds to wholesaler	100% men
Wholesalers	4	•Exporting •Packing weighing, •Transporting Fee and tax paying	•Buy fruits from village traders •Selling fruits and pulp to large-scale in urban areas	100% men
Retailers	4	•Processing (Separate powder from seed embedded with pulp in a sack). •selling to final local consumers	•Buy pulp/seeds from market from wholesaling •Selling directly to consumers	100% men
Consumers	9	•Buying from retailers	Buy fruits and pulp from retailer	66.7% men 33.3% women

The identified actors involved in baobab fruits trade in the study areas were shown in figure 2

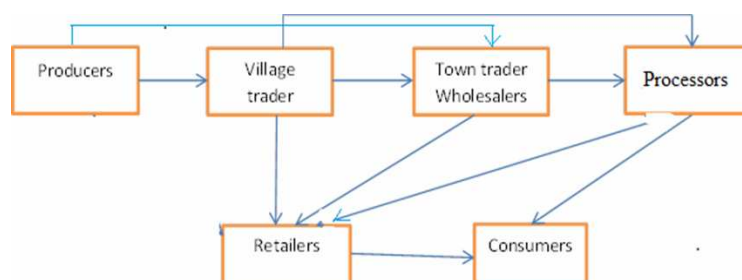


Figure 2. Actors involved in baobab fruit trade

Different actors involved in moving a product from the production to the final consumers and each actor has different abilities to influence the chain (Marshall *et al.*, 2006). Due to the Gibbon and Ponte (2005), the use of the term channel or chain suggested a focus on relationships between buyers and suppliers, and the movement of a good or service from producers to consumers.

The value chain analysis is a good tool to facilitate entering products in the market. Various actors involved in baobab trade were identified in this study in moving a product from producers or gathers to final consumers. There is different role of these actors such as collecting, drying, cracked fruit, packaging, storing, marketing and selling. Subsequently, adding value to the baobab fruit pulp at each stage of the chain. Different actors have a role that is important in the successful commercialization of the product, and each actor has different motivations and abilities to influence the chain (Marshall *et al.*, 2006). Producers gathering and harvesting practices of baobab fruit, the family provides the majority of labour, and the farm provides the principle source of income. Comparing based on this broad definition, the surveyed households in Mali and Benin can be categorized as smallholders, because individual gatherers of baobab fruits and other products in Mali and Benin were part of a family or household (De Caluw, 2011). Producers or harvesters were the first actors enter the chain of baobab fruits trade. Comparing tree fruits from miombo woodlands are particularly central to the livelihood systems of both rural and urban dwellers in Southern Africa (Akinnifesi *et al.*, 2005). The current study together with

Akinnifesi et al. (2005) identified that- regardless of baobab trees growing in the rural areas- both the rural and urban communities benefit from them through trade and consumption.

From the analysis, it revealed that the baobab fruits in the Blue Nile State was controlled by village traders. The main problem has been that there were only one or two village traders in the district, and thus competition is almost not-existent. The reasons for the small number of buyers could include the high capital cost of purchasing stock and acclimatization into a new business (Olsen, 1999). The first actors to enter the chain of baobab trade were the producers, they got their baobab fruits from both individually claimed trees found around the households or farmlands and reserved forests. Fruits were collected by everybody as the trees grow in the reserved forest. Mess market relationship was observed when consumers were not choosing a particular trader for the baobab fruits they want to buy.

3.2. Source of baobab fruits

Two main sources of baobab fruits in the study area were identified as individually claimed trees (90%) and reserved forests (10%) (e.g. Elgerri forest) by interviewees. The study showed that the majority of participants were tree owners (90%). For those tree owners who were enable to climb the baobab tree (90%), have a good skill to harvest and transport the fruits by themselves, sometime their preference was to sale the whole tree with its fruits. The same table indicated that 93.3% used baobab fruits and pulp for consumption and sale, whereas 6.7% of the respondents use fruits just for sale. The study findings revealed that 60% and 86.7% of the respondents in the study area, observed the baobab fruits are available and ripen, respectively, in October and December. Whereas 50% of the respondents showed that baobab fruits available during the season and for four months. The study results indicated that 100% of the producer's sale the product for the venders especially those who from the villages.

3.4 Benefits distribution along the value chain

Baobab fruits were produced, sold and consumed by many respondents in Blue Nile State. Table 2 revealed that the trade along the chain was associated with variable cost, revenue, gross income and gross margins. The same table indicated that the wholesalers had the highest variable costs (35,875 ± 13090), revenue (800,475 ± 29022), and gross income (764,600 ± 2.7790). The lowest gross margin (87.97 ± 0.658) and variable costs and revenue (2,189±32882) were incurred by producers. Whereas producer's harvesters seem to give top gross margin (96.84%), while the least gross margin (62.61) was associated with retailers. The producers getting the highest gross margin (96.84%) this is due to variable cost not considered because it is very little to see as packages. This result is agreed with (Nellie, 2018) who reported that the reason behind producers getting the highest gross margin, the only cost incurred by them is for packaging. Due to of Jensen's study (2009) which showed that producers (harvesters) have only inputs in agar wood value chain is labor and transportation costs and this indicates that harvesters have less expenditures than do any other groups of actors, and can make considerable returns.

Table 2. Mean variable costs, mean revenue, gross income and gross margin for actors in baobab trade

Category of actor	Variable cost (Mean ±SE)	Revenue (Mean ± SE)	Gross income (Mean ± SE)	Gross margin% (Mean ± SE)
Wholesaler	35,87 5± 13090	800,475±29022	764,600±2.7790	87.97±0.658
Village trader	3,312.5 ± 12451	66,430±25991	63,117.5±2.479	85.67±0.524
Retailer	5,398 ± 13114	50,748±28590	45,350±2.8085	62.61±11.015
Producer	59.33±19.26	2,189±32882	2,129.66±3.2410	96.84±0.666

*1 US\$=45.11 SDG

Table 3 depicted that the distribution of fixed cost, total cost, selling price, buy price and added value are significant different across actors($p = 0.05$) wholesalers incurs the highest, total cost buying prices, selling price and added value, whereas the lowest of these above area incurred by producers and retailers.

Table 3. Fixed cost, total cost, selling price, buying price and added value for each the actor

Category of actor	Variable cost (Mean±SE)	Fixed cost (Mean ±SE)	Total cost (Mean ± SE)	Selling price (Mean ± SE)	Buy price (Mean ± SE)	Added value (Mean ± SE)
Wholesaler	35,87 513090	64,419±2616	100,294±38076	800,475±290220	66,979±28415	130.680±4.74912
Village trader	3,312.5±12451	6,435.33±277	9,747.83±3982	66,430±259913	64,190±3000	2,400±5.51109
Retailer	5,398 ± 13114	3,785.6±2645	9,183.6±32496	72,080±462684	55,686±3628	16,393±1.00023
Producer	59.33±19.26	0	59.33±19.26	0	2211.76	0

*1 US\$ = 45.11 SDG

4. Conclusion and Recommendations

Actors in baobab fruits value chain can be categorized and were identified in this study namely; producers (harvesters or collectors), village traders, wholesalers, processors, retailers, consumers, and exporters (not being studied). Benefits of the business included promotion of cash incomes and employment opportunities for different actors involved in the baobab fruits value chain. This study has found that spot market relation was the most common type of relationships between actors in the study areas, which is not efficient and effective as it comes with little or no trust amongst actors. The wholesalers have higher revenues as they sell large quantities and added value to their products which are sold at higher price even locally. For those accrue low revenues as producers who created low value to the baobab produce at local markets.

Further investigations are needed on the actors involved in baobab fruits trade especially local processors on big city and exporters to international markets. The Baobab fruits value chains seem to be buyer-driven led by big traders and processing companies at the downstream end of the value chains. This could be done by improving the negotiating power of baobab fruits producers or collectors by encouraging their associations to play an active role in price setting and sharing transportation cost to potential products markets.

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