



Value Chain Analysis for *Ziziphus spina - christi* in Sheikan Locality, North Kordofan State, Sudan

**Faisal I. Musa^{1*}, Osman E. A. Abdelkareem¹, Hamdoon A. Abdelrhman¹,
Muneer E. S. Eltahir², Seif Aldin D. A. Fragallah¹, Elmugheira M. I. Mohammed³,
and Mohammed O. Hassan²**

¹Faculty of Natural Resources and Environmental Studies, University of Kordofan, El Obeid, Sudan.

²Institute of Gum Arabic Research and Desertification Studies, University of Kordofan, El Obeid, Sudan.

³Faculty of Forest Sciences and Technology, University of Gezira, Gezira, Sudan.

Authors' contributions

This work was carried out in collaboration among all authors. Authors FIM, OEAA, HAA, MOH and EMIM designed the study, performed the statistical analysis. Author FIM wrote the protocol, and wrote the first draft of the manuscript. Authors FIM and MESE managed the analyses of the study. Author FIM managed the literature searches. Authors SDAF and MESE revised the study, read and approved the final manuscript.

Original Research Article

Received 27 February 2021

Accepted 03 May 2021

Published 05 May 2021

ABSTRACT

Fruit of *Ziziphus spina christi* (Nabag) plays an important role in the malnutrition prevention, fresh eaten or left to dry for later consumption. This study was conducted in *Shiekan* Locality, North Kordofan State, Sudan in 2019. The aim of this research paper is to identify different actors that involved in value chain of *Ziziphus spina - christi*. Random sampling technique was applied where eight villages were randomly selected. A total number of 86 respondents representing household heads were chosen to represent 10% of total households, twenty-five traders were interviewed beside fifteen respondents from processors who were also interviewed. Bio-physical data were collected using 320 circular sample plots with radius of 35.7m (0.4 hectare). Data was analyzed using Microsoft Excel 2010 and SPSS version 22. The results of bio-physical revealed that the mean density for different species was 34 trees while the highest density for *Ziziphus spina - christi* was 11 trees. Result indicates that, the actors involved in value chain of *Ziziphus spina - christi* are collectors, village traders, city merchants, wholesaler, retailer and consumer at local level. The value chain is short especially in processors and exporters. Gross margin in whole chain demonstrated that wholesalers are the most benefited ones 34.8%. It was also noticed that collectors sell their products immediately after collection with low prices to the traders. The research recommended that rural people who deal with *Ziziphus spina - christi* should be provided with knowledge to improve techniques of harvesting, processing, development of markets and marketing channels.

*Corresponding author: Email: faisalwww34@gmail.com;

Keywords: Value chain analysis; *Ziziphus spina – Christi*; NWFPs; Kordofan; livelihood.

1. INTRODUCTION

Forests provide diversified wood and non-wood products that under sustainable management can improve income and livelihood of local communities and foster their economic development [1]. NWFPs are important resources for the country [2] Fruits are most significant revenue generation for rural and urban areas and much needed in drought and famine times, consequently wild fruits substitute to reduce poverty and hunger [3-5]. The NWFPs were used as source for income generation [5-7]. A value chain explains the complete choice of required activities to bring service or product from the beginning, through the in-between stages of production (producer services inputs and transformation) delivery to last consumption or clients and ending removal after usage [8-11]. Non-wood forest products (NWFPs) significantly donate to the livelihood, nutrition and food security of rural societies and forest inhabitants [12]. NWFPs represent central element of sustainable progress and sustainable forest management [13]. Production and marketing of NWFPs in Sudan play an important socio-economic role as sources of cash income and national wealth [14]. *Ziziphus spina-christi* is tree or deciduous shrub belongs to family *Rhamnaceae*. It is commonly called "Sedr", furthermore, known as 'Nabag' [15]. Fruit plays an important role in the malnutrition prevention, fresh eaten or left to dry for consumption at a later date like *Nabag* (fruit of *Zizyphus sp.*) [16]. This is particularly important for crops which can withstand harsh conditions such as drought, heat and salinity stress. An

example of such a species is *Ziziphus spina christi* (L.) Willd [17]. Rural populations in Sudan, especially in the central and western parts of country, often rely on it to fulfil their food and energy needs [17]. *Z. spina-christi* is the most plentiful wild fruit tree used in home gardens in Sheikan, [18]. The development of NWFPs research in the field of livelihood, policy provision, and the value chain had also increased over the periods [12]. This research paper aimed to declare the important of *Ziziphus spina – Christi* and to find different actors that involved in its value chain.

2. MATERIALS AND METHODS

2.1 Study Area

Sheikan locality lies in the middle of the Kordofan between latitudes 25° 12', 45' 13' North and longitudes 35' 29', 30' 30' east [5,19,20]. It is found in the Savannah area [19]. It covers an area of about 8312 Km² (≈2 million acres), mostly useful for grazing activities and agriculture [20]. Moreover, Sheikan locality situated within the semi-desert zone where the average annual rainfall is between 250-450 mm²/year during the rainy season (June to October). The last ten years revealed much fluctuations in rainfall [20,21]. Acidic to alkaline sandy plains are dominant in northern parts of Sheikan locality and cover about 75% of the total area whereas, in the southern parts of the locality clay and Gardud soils cover about 5% and 20% respectively. The sandy soils share similar properties with the Qoz land soils. The sandy clay and sandy clay loam soil, locally known as



Fig. 1. *Z. spina-christi* tree (A) and fruits (B) in study area (Photo credited Faisal and Muneer)

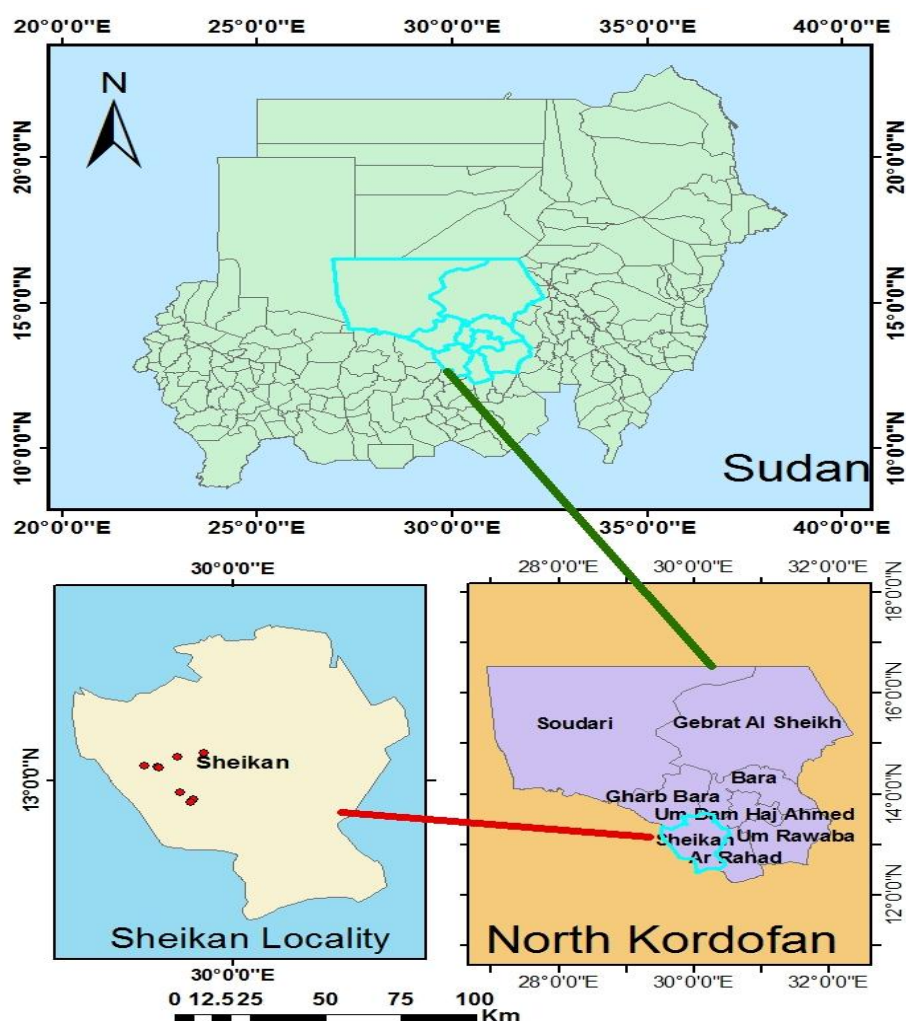


Fig. 2. Map of the study area and respondent's village (*Abu Haraz* administrative unit)

"Gardud", have subsurface horizons of clay accumulation [20]. The economic activities of the population in *Abu Haraz* Administrative Unit they use several types of economics activities included, agriculture (cropping sorghum, sesame, milt and Hibiscus), animal rearing, and collecting of forest products (wood and non-wood forest products).

2.2 Data Collection

2.2.1 On farm data

Bio-physical data were collected around the selected villages in four directions where two kilometers orientated in each direction to know the amount and distribution of trees species in study area and particularly *Ziziphus spina Christi*. A total 320 Circular sample plots used with

radius of 35.7m (given an area of 0.4 hectare) and the distance between each two adjacent sample-plots was 200m [22, 23]. In each sample plot the tree species were recorded as well as the general observation and the soil type was recorded as remark. Also, the associated species and their distribution were considered.

2.2.2 Socio-economic data

The questionnaire was designed, pre-tested and distributed randomly among eight villages, targeted the local people who deal with *Nabag*. Eight village's out 83 villages were selected. A Number of 86 respondents were chosen to represent 10% of total households. Two types of market were identified and investigated; rural markets representing by *Abu Haraz*, *Tena* West and; central markets represented by *Ibn Masoud*

and *Wad Ekaifa*. Twenty-five traders were interviewed in targeted rural and central markets and fifteen respondents for processors who were also interviewed. The role of taxes and fees on the production and marketing of *Nabag* and their benefit to the rural communities was gathered. Secondary information including published and unpublished materials as well as reports was used. Beside related data was gathered from different institutions such as Forests National Corporation (FNC) and Zakat Office.

2.3 Data Analysis

Data collected from the study area were statistically analysed using Microsoft Excel 2010 and SPSS version 22 to get descriptive statistics, frequency, comparison, and construction of diagrams. The descriptive statistics was used where percentage and frequencies were calculated. This fact was used to analyse the socioeconomic characteristics of the farmer as well as the quantity of *Nabag* productions. Gross margin analysis was used for cost and benefits analysis of *Nabag* grown in the areas of study and it's a method of organizing data and information about the costs and benefits of several alternative activities to calculate gross field benefit [5]. It is necessary to know the field prices of Non wood forest products and total cost of production from each product. The calculations were based on the following formulas:

$$GM = TR - TVC \text{ while } TV = \text{sale volume} \times \text{unit price}$$

Where:

$$GM = \text{Gross margin (SDG)}$$

TR = Total revenue or total value of output from the NWFPs production (SDG).

TVC = Total variable cost or the costs that are specific in Producing NWFPs (SDG).

$$\text{Gross Margin \%} = \frac{(\text{revenue} - \text{total cost})}{\text{revenue}} \times 100$$

$$\text{Density /ha} = \frac{\text{area of hectare}}{\pi r^2} \times \text{number of trees plot}$$

Where:

$$\pi = 3.14 \text{ and } R^2 = \text{Radius of the sample plots [24]}$$

3. RESULTS AND DISCUSSION

3.1 Tree Species Diversity

Table 1. mention the present tree species in the study area, the number of each species /ha, the mean density /ha was 34 trees, while the average density of *Nabag* was 11 tree /ha in study area. The highest density /ha among different species was *Nabag* 11 trees which showed that the quantity of *Nabag* is better and has more density than other tree species. Additionally; this entire species in the agriculture land, the local people they conserve it to use their fruits for sources of income particularly *Nabag*. Moreover, there is small quantity of regeneration of *Nabag* species because there is no security after harvesting the farm and non-wood forest products this leads to grazing by domestic animal while may reduce the new generation of *Nabag* species. However, the local community conserve other species for charcoal, building material and fire wood, also *Acacia senegal* has much percentage because produce gum and help them in generating income.

Table 1. Tree species status, and their density /ha in Abu haraz

Name of species	Mean tree/plot	Density/Hectare
<i>Ziziphus spina – Christi</i>	4.2375	11
<i>Grewia tenax</i>	3.8063	10
<i>Balanites aegyptiaca</i>	1.0375	3
<i>Boscia senegalensis</i>	1.1438	3
<i>Capparis decidua</i>	0.0875	0.22
<i>Acacia oerfota</i>	1.15	2.9
<i>Faidherbia albida</i>	0.23	0.58
<i>Acacia Senegal</i>	1.375	3.44
<i>Tamarindus indica</i>	0.0438	0.11
<i>Albizia amara</i>	0.3063	0.77
<i>Adansonia digitata</i>	0.1375	0.34
<i>Acacia seyal var seyal</i>	0.0125	0.03
Overall average	13.5677	34

3.2 Proportion of Community Land Covered by *Nabag*

Table 2 explain the proportion of community land cover by *Nabag* species which divided in many portions where 25.6%, of respondent stated that *Nabag* cover their land area greater than fifty percent, while 28% and 46.3% of respondent stated that *Nabag* cover their land area 33% and less than 33% respectively. but, the mentioned percentage within the agricultural land, this result indicates that the conservation of *Nabag* species in farm land which managed and conserved by rural people in study area and using system of agroforestry. This confirms with, Cooperation in tree planting and forest protection is centred on the approach, [25-27]. Also, it may be grown as an orchard crop in a pure stand, as an agroforestry species in mixed cropping systems including home gardens, or as a hedgerow [3,18].

3.3 Source, Time and Distance of Collection of *Nabag*

Table 3. explains that all collectors in the study area gather, *Nabag* from farmland 100%, this leads to management and conservation of rural community to forest tree inside their farm beside agriculture products. The results revealed that the most of respondents collected *Nabag* from a distance of 2 - 3 Km, this return to availability of trees in study area and inside farm land too. On the other hand, the inhabitants of the study area do not go far distances for collection of NWFPs because it was available in their farm and they conserve it and they considered it as secondary sources of income from their farm.

Table 2. Proportion of community land covered by *Nabag*

Cover %	<i>Nabag</i> %
>50%	25.6
33%	28.0
<33%	46.3
Total	100

In addition to that; Based on the result in Table 3. demonstrates that the time spent in collection per

trip of *Nabag* ranged between 1 to 8 hours, while the most of respondents stated that they spent 3 to 4 hours for gathering *Nabag*.

3.4 Quantity of *Nabag* Collected Per Month by Household

The average quantity of *Nabag* collected per month was weighing 236.85Kg Fig. 3. this mean that it's easy and simplicity to collect big quantity within short time. The related study indicates that families with big force of labour on account of their size can gathering much products from farm or forest than a smaller labour force in the household to meet their need for cash income [6]. This result finding agrees with research conducted in South India by [28] where this research informed that added revenue from NWFPs actions come from big households' number.

3.5 Market of *Nabag*

Middlemen, traders are remaining essential for commodities that need a bit long time interval, storage facilities and space and energy inputs such as products that must be dried, stored, processed, transported and packed before distribution [29]. The fruits are consumed locally or sold to generate income in the market [30,31,32]. From previous agrees studies the result revealed that the market types divided into three categories home, weekly rural market (*Um duaruar*) and urban market. Moreover, Result in Table 4. describe where the collectors market their *Nabag* while they depend on the accessibility and quantity of product, 48.8% of respondent stated that they sell the *Nabag* in rural market; this mean availability of transport and other facilities to rural market than other market, in the same time the income of *Nabag* they exchange it by other goods; also, may reduce the cost of transport and time.

However, Table 4. showed that 46.3% of respondents prefer to sell their products in urban market this led to available of time and customers of respondent; in this case also the income of products is increase than purchase it in rural market while the cost of transport

Table 3. Source, time and distance of collection of *Nabag*

Actor	Places of collection		Distance for collection (km) (%)				Time for collection (hours) (%)			
	Farm	Forest	1-2	2-3	3-4	4-5	1-3	3-4	4-5	5-8
Collectors	100	0	19.8	47.7	24.4	8.1	8.1	76.7	4.7	10.5

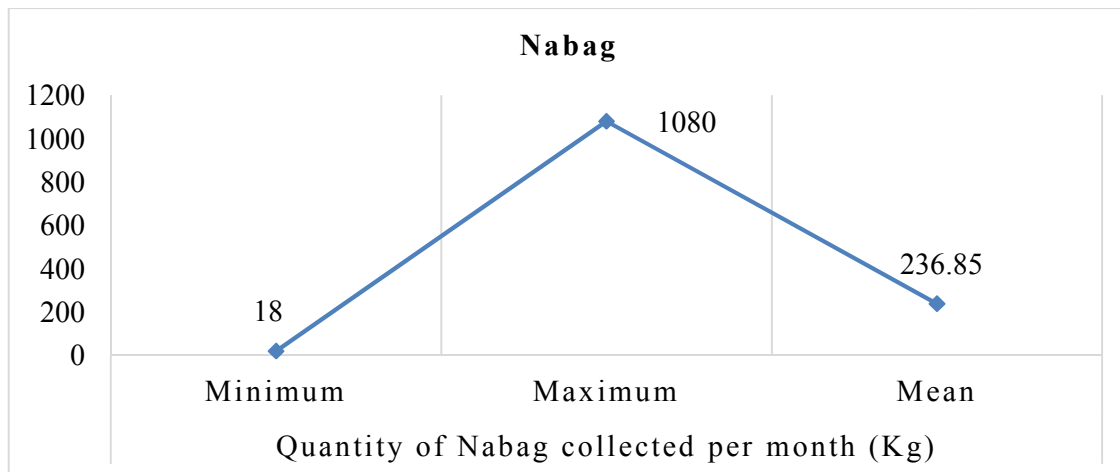


Fig. 3. Quantity of *Nabag* collected per month by household

Table 4. Market of NWFPs

Market place	Respondents (%)
Home	4.9
Rural market	48.8
Urban market	46.3

increase too. Furthermore, the rural people they sell their products direct when they collected and received low gross margin because there are poor storage facilities.

3.6 Gross Margin Percentage Out of Last Consumption for *Nabag*

The total gross margin of *Nabag* was 82.94% which distributed to actors involve in the chain, the highest percentage was received by collector 34%, however, the other actors received less gross in case of 45Kg but they trade more quantities than collectors, this means the gross

margin of other actors will increase in selling and purchasing more quantities Fig. 4. the result agrees with, in various cases such product is sold and bought several times, adding value at each stage, before reaching the consumer and/or last user [29].

3.7 *Nabag* Total Variable Cost Percentage 45 Kg Out of End Use

17.3% was total variable cost of *Nabag* of last consumption at local level, 6% was the high cost which received by the collector this means that the operation of production so expensive compared with other operation, the payment for commodity market preparation about 3.83% was paid by village trader, city merchant 1.5%, wholesaler was 3.73% and retailer was 2.23% of last consumption at local level, the other actors received lower cost because their operation or activities less than collectors, Fig. 5.

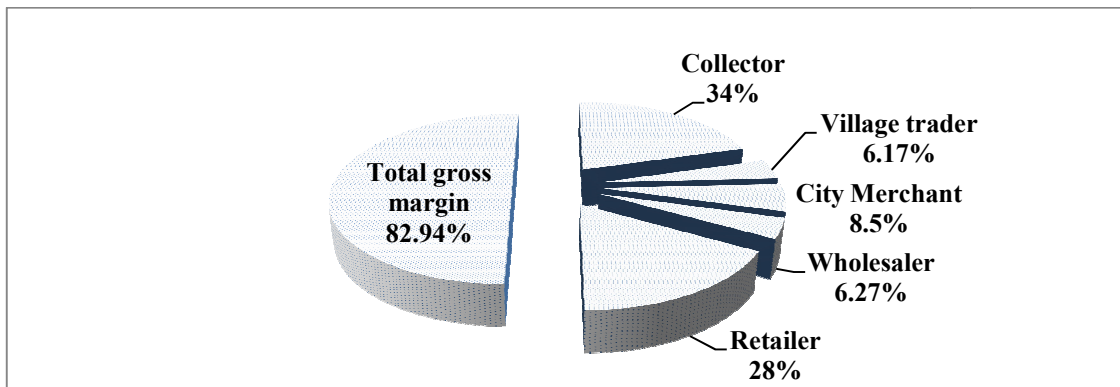


Fig. 4. Gross margin percentage out of last consumption for *Nabag*

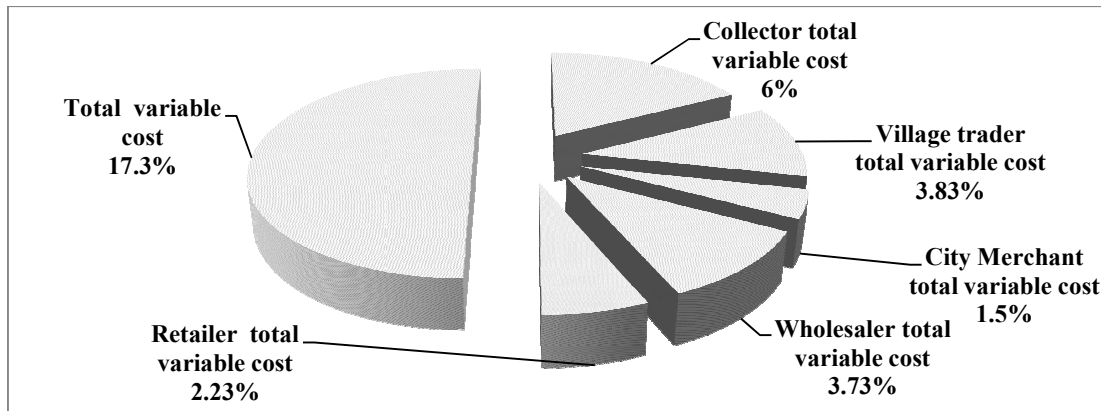


Fig. 5. Nabag variable cost percentage 45Kg out of end user 2019

3.8 Compare between Gross Margin for Actors per 45Kg and Per Season

The gross margin of actors involves in Nabag fruits value chain 45Kg and per season which mention in Fig. 6 below, the average quantities produced, purchased by traders and consumed by end user respectively are given per season. In the case 45Kg the highest gross margin was received by collectors 41.1%; while in the average quantities supply per season the highest gross margin was received by wholesaler 34.8%, this indicates the total distribution of the gross margins among the Nabag actors, the wholesaler earning highest measure, followed other actors involved in the chain because the collectors they collect specific quantity per season according to time and availability of product in study area while the wholesaler purchase the product from different collectors and other actors that lead to increase his gross margin. These disparities

emerge from difference number of actors group and gross margin shared by them.

3.9 Nabag Total Gross Margins and Total Cost out Final Consumption

Fig. 7 Explains the total gross margins were (82.94%) of last consumption at local level price consisting of collector 34%, village trader 6.17%, city merchant 8.5%, Wholesaler 6.278% and retailer 28%. The total variable cost 17.3% of which production cost 6%, village trader 3.83%, city merchant 1.5%, wholesaler 2.5% and retailer it was 1% beside other related institutions benefits was 1.14% for FNC, 0.66% for Zakat and Taxes office was 0.66% with total 100% representing all Nabag value chain activities from producer to last consumption at local level however, the actors received positive gross margin and its good compared with the variable cost.

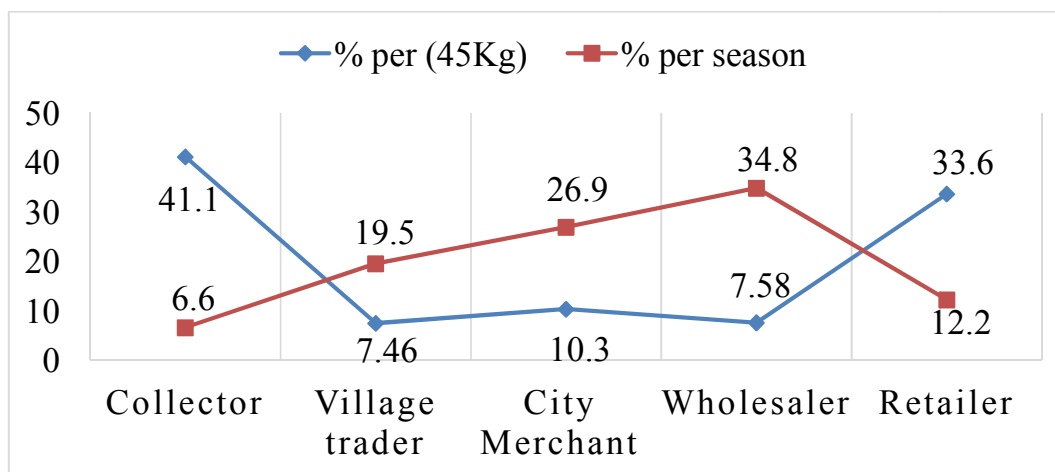


Fig. 6. Comparison between gross margin for actors per 45kg and per season

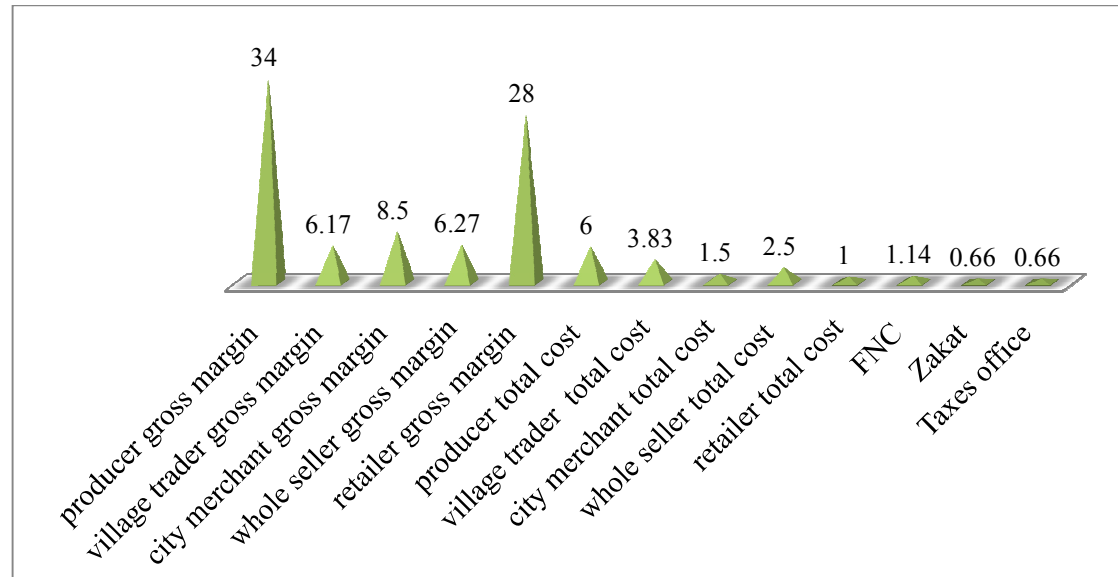


Fig. 7. total gross margins and total cost out final consumption of Nabag

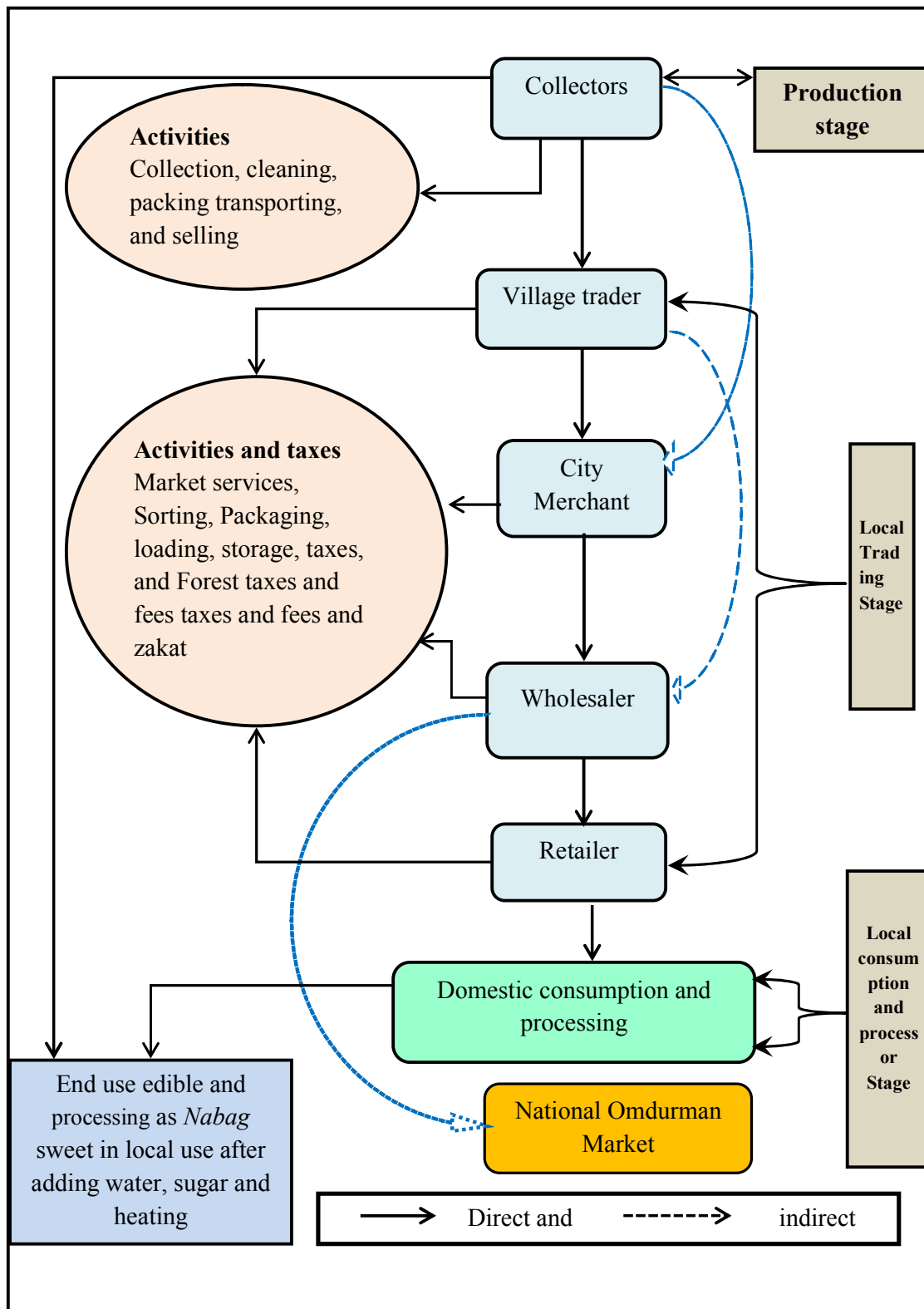


Fig. 8. Conceptual Framework of *Zizipus spina - christi* (Nabag) (authors 2019)

Source: Developed from the field study and market surveys, 2019

3.10 Conceptual Framework of *Zizipus spina - christi*

value chain of *Nabag* divided into three-stage, the Fig. 8. Explain *Nabag* actors, many actors are involved in the *Nabag* chain as the commodity moves from production through the domestic market, wholesale and end-user. Mapping and description of commodity chain of the actors who were involved in the chain of *Nabag* and their principal activities. Quantifying the physical flow value added and distribution of benefit along chain. moreover, Fig. 8 describe the value chain of *Nabag* to end use at local consumption for 45kg to calculate gross margin and total variable cost for every actor in the chain. The chain moves from producers to village traders to city merchant to wholesaler to retailer to finally end user or last consumption at local level.

4. CONCLUSION AND RECOMMENDATION

Overall average tree /ha was 34 trees while the percentage *Nabag* was 11 tree /ha, beside other associated species like *Acacia senegal* as considerable percentage, the most of the respondents in study area are the farmer depending basically on agriculture for their life subsistence and collection of *Nabag* and NWFPs. The actors involve in the value chain of *Nabag* they are collectors, village traders, city merchants, wholesaler, retailer and consumer at local level. The value chain very short especially in processors, exporters. Gross margin in whole chain demonstrated that wholesalers are the most benefited once 34.8%. It was also noticed that collectors sell their products immediately after collection with low prices to the traders. The research recommended providing rural people with knowledge that enables them to improve techniques of harvesting, processing, developing of local markets and marketing channels of *Nabag* for substantially production and profitable marketing.

ACKNOWLEDGEMENT

The authors are grateful to local leaders of *Abu Haraz* Administrative Unit, research assistants, and rural communities in the districts. Acknowledgement extends to the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) for facilitating and Mastercard Foundation for the fund.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Stryamets N, Elbakidze M, Angelstan P. Role of non-wood forest products for local livelihoods in countries with transition and market economies. *Scandinavian Journal of Forest Research*. 2011;41:1–14.
2. Purwestri Ratna C, Hájek Miroslav, Šodková Miroslava, Jarský Vilém. How are wood and non-wood forest products utilized in the Czech Republic? A Preliminary Assessment of a Nationwide Survey on the Bioeconomy Sustainability. 2020;12(2):56. Available:<https://doi.org/10.3390/su12020566>
3. Gebauer J, El-Siddig K, El Tahir BA, Salih AA, Ebert G, Hammer K. Exploiting the potential of indigenous fruit trees: *Grewia tenax* (Forssk.) Fiori in Sudan. *Genetic Resources and Crop Evolution*. 2007; 54(8):1701–1708.
4. Maske M, Mung A, Kamble R, Chaturvedi A, Chaturvedi A. Impact of non-timber forest products (NTFPs) on rural tribes' economy in Gondia Distric of Maharash; 2011.
5. Ibrahim E, Ibrahim Omnia Abdelrazig Abdo. Productivity and economics of gum arabic in Sheikan Locality, North Kordofan State, Sudan. *International Journal of Agriculture, Forestry and Fisheries*. 2017; 5(6):113-116.
6. Adam YO, Pretzsch J. Contribution of local trade in *Ziziphus spina-christi*- L. Fruits to rural household's economy in Rashad locality, Sudan. *Forestry Ideas*. 2010; 16(39):19-27.
7. Chilalo M, Wiersum FK. The role of non-timber forest products for livelihood diversification. *Southwest Ethiopia, Ee-JRIF*. 2011; 3(1):2011.
8. Kaplinsky R, Morris M. A Handbook for Value Chain Research. IDRC; 2000. Available:<http://www.ids.ac.uk/ids/global/pdfs/VchNov01.pdf>
9. FAO. Commodity Chains for Pro-Poor Rural Growth. Operational Guidelines, Rome; 2004.
10. te Velde, Dirk Willem, Jonathan Rushton, Kathrin Schreckenber, Elaine Marshall, Fabrice Edouard, et al. *Entrepreneurship in*

- value chains of non-timber forest products. *Forest Policy and Economics*. 2006;8:725–741
11. El Tahir BA, Vishwanath A. Market and value chain analyses of marketable natural products from agroforestry systems in Eastern Sudan. *Journal of Geoscience and Environment Protection*. 2015;3:57-73.
12. Ravi Sharma, Nisha Bharti. Non-timber forest products value chain toward sustainable livelihood: exploring linkages and trends using visual optimization network analysis. *Asian Journal of Agriculture and Development*. 2020;17(2).
13. Martinez de Arano I, Maltoni S, Picardo A, Mutke S, et al. Non-wood forest products for people, nature and the green economy. Policy priorities for Europe. A white paper based on lessons learned from around the Mediterranean. Deliverable 3.3 of the European Thematic Network INCREDible, Horizon2020 grant agreement n° 774632; 2021.
14. Gereffi G. Shifting governance structures in global commodity chains, with special reference to the internet. *American Behavioral Scientist*. 2001;44(10):1616-1637.
15. Khaleel SMJ, Jaran AS, Haddadin MSY. Evaluation of total phenolic content and antioxidant activity of three leaf extracts of *Ziziphus spina-christi* (Sedr) Grown in Jordan. 2016;14(6):1–8. Available: <https://doi.org/10.9734/BJMMR/2016/24935>
16. Deafalla Taisser HH, Dafa-Alla MD, Mustafa M. El Abbas. The importance of non-wood forest products for rural livelihoods: The case of South Kordofan state, Sudan; 2017.
17. Saied Amina Sirag, Jens Gebauer, Karl Hammer, Andreas Buerkert. *Ziziphus spina-christi* (L.) Willd: A multipurpose fruit tree. *Genetic Resources and Crop Evolution*. 2008;55:929–937.
18. Gebauer J. Plant species diversity of home gardens in El Obeid, central Sudan. *JARTS*. 2005;106:97–103.
19. IFAD. Evaluating the agricultural season in North Kordofan State. Final Report, Records of Ministry of Agriculture and Livestock. North Kordofan State, Sudan. 2003;46.
20. Salih Saher. Mohammed S, Kamal F, Elkhailifa, Eltahir, Muneer ES, Haytham H. Gibreel. Assessments of vegetation cover change and dynamic in Sheikan, North Kordofan, Sudan. *Species*. 2019;20:181-190.
21. Khatir AA. Application of Resource Assessment and Management Support for Pastoral Systems (RAPS) model to analyze pastoral systems in North Kordofan State, Sudan, PhD theses, University of Kordofan. 2012;150.
22. Osman EH, Idris EA. Species dynamics and potential disturbances in El Nour Natural Forest Reserve, Sudan. *Journal of Forest Products & Industries*. 2012; 1(2):10-20.
23. Mohammed Elmugheira, Hassan Tarig. Factors affecting natural regeneration and distribution of trees species in El-Nour Natural Forest Reserve. 2015;3:16-21.
24. Etigale EB, Ajayi S, Udofia SI, Moses MU. Assessment of stand density and growth rate of three tree species in an arboretum within the University of Uyo, Nigeria. *Jjournal of Research In Forestry, Wildlife And Environmental*. 2014; 1.
25. Elsiddig EA. Management of dry -land forest reserves in Sudan based on participatory approach. In Elsharahan AS, Wood WW, Goudie AS, Fowler A, Abdellatif EM. Desertification of the Third Millenniu., 2003;361–364.
26. Glover Edinam K. Tropical dry land rehabilitation: Case study on participatory forest management in Gedaref, Sudan. Doctoral Thesis. University of Helsinki, Helsinki, Finland; 2005.
27. Abdel Magid, Talaat D, El Tiab A Abdalla, El Nour A, El Siddig. Participatory management of natural forests in Sudan – Case of El Rawashda; 2014.
28. Hegde R, Enters T. Forest products and household economy: A case study from Mudumalai wildlife sanctuary, South India. *Environmental Conservation*. 2000; 27(3):250–259.
29. Taha Mohamed E, Hala A Rizig, Hatim M, Elamin A, Eltahir, Muneer ES, Tsegaye Bekele. Role of non-wood forest products in welfare of beneficiary stakeholders in Sheikan Locality, North Kordofan State, Sudan. *International Journal of Agriculture, Forestry and Fisheries*. 2015;3(4):129-136.
30. Galizia MD, Gruenwold J. Market brief in the Euepean Union for selected natural ingriedients derived from native species. *Adansonia digitata* L. (baobab) united Nation's conference on trade and development (UNCTAD). Bio Trade

- Initiative / Bio trade Facilitation Programme (BTFP). 2005;22.
31. Basavarajappa TP. Non- Timber forest products (NTFPs) for Food and livelihoods security: An Economic study of tribal Economy in Western Ghats of Karnataka, India. MS. C of Science in rural Development. Ghet University; 2008.
32. Bein E, Ogbazghi W. Assessment of non-wood forest products and their role in the livelihoods of rural communities in the Gash- Baraka, Regions, Eritrea. DCG Report. 2006;40(19).