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Assessment of the fuelwood value chain in Yobe, Nigeria

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Abstract. This study aims to assess the characteristics of the fuelwood value chain in Yobe, Nigeria. Data were collected through state government records, direct observations, focus group discussions, and interviews with key informants using open-ended questionnaires. Results showed that the fuelwood value chain comprises five functions: harvesting, transporting, trading, retailing, and consumption. The analysis further revealed five sub-chains characterized by actors in which two sub-chains were classified as formal (registered with associations and functioning with licenses) and three were classified as informal (not registered with an association and functioning without license). The presence of informal actors in the value chain observed in this study is widespread due to weak governance, high fuelwood demand, and corruption. Consequently, their poor practices have added extra pressure on the forest and is threatening the environment, fuelwood availability, accessibility, and market. The intrusion of informal actors needs to be properly addressed by the government through measures that include an efficient and flexible licensing system, strict implementation of fuelwood regulations, active monitoring, increase of awareness on the benefits of licensing and operating as registered actors in an organized group on job security, profits, and the environment and improved supervision of the forest laws' enforcement agents to curtail corruption.

Keywords: Fuelwood, Value chain, Supply chain, Functions, Sustainable practice

1. Introduction

Fuelwood or firewood is a primitive source of energy, and the material can be obtained from trunks, branches and other parts of trees [1]. It is one of the most utilized sources of energy across the globe for cooking and heating. About one third of the world population utilizes fuelwood for cooking, and household's fuelwood reliance is the highest in Africa as it accounts for about 53%, [2] and its use is prominent among rural communities [3]. In Nigeria, where a fairly large proportion of the population lives in rural areas, the demand for fuelwood as a source of energy is high and accounts for up to 80% of the total energy consumed [4], and its use is anticipated to continue for a long time [5]. The prevalent use of fuelwood is not only limited to households but extends to non-domestic uses for food preparation in schools and restaurants as well as other small-scale traditional industries and commercial enterprises, such as bakeries as well as tea pottery, and fish smoking shops [6]. The

excessive use of fuelwood in the region is a result of a number of factors including insufficiency and high price of other energy alternatives, ease of use, poverty, accessibility, availability and affordability [5], [7].

In Nigeria, fuelwood is not only consumed by rural communities but is also popular among the urban population. This situation together with the increased distance to fuelwood collection centers have been cited to have promoted the commercialization of fuelwood in the region [8,9]. Larinde and Olasupo [10] noted that increased commercialization activities have caused unsustainable harvesting and extraction practices whereby dead and living branches and trunks of whole trees were extracted by collectors. These unsustainable extraction practices have been regarded as one of the potential causes for forest degradation, deforestation and desertification in Nigeria [9].

Although the fuelwood sector has been criticized due to the perceived environmental degradation, fuelwood commercialization activities have been recognized as enhancing livelihoods and offering regular income generation to those who are involved in harvesting, transporting, trading and selling fuelwood to the end consumer in the market [9]. The sector has also been acknowledged to contribute to poverty reduction and consequently, economic development—provided that fuelwood is sourced, produced, distributed, and consumed sustainably along the value chain [11]. Therefore, approaches that can promote sustainable practices from the point of its production to end consumption are desirable in order to eliminate the cause for which its utilization is perceived detrimental. One of the means to achieve this is by addressing the value chain holistically. Value chain analysis provides an illustrative representation of the identified chain actors and the related product flows. Thus, the charted value chain reveals all the actors and their relationships with one another and the economic activities of all the elements that composed the structure [12]. It is a tool used to understand the sequence of related business activities from the collection of raw material to end consumption in order to promote the relationship between all actors, improve productivity and profitability, and ease the recognition of challenges and identification of better ways to understand the measures for which the challenges can be addressed [12].

Previous studies related to the fuelwood value chain have received little attention as compared to other types of wood fuels (i.e., charcoal) [13;14]. A recent study conducted by Puentes-Rodriguez et al. [15] analyzed the fuelwood value chain in Burkina Faso and found that simultaneous action from both formal and informal actors in the value chain affects the pricing of the fuelwood and causes the uncontrolled exploitation of the forest resource. Guild and Shackleton [11] in another recent study of the fuelwood value chain in selected cities in South Africa found that the informal fuelwood market acts as poverty alleviator whereby poor people who typically received government social grants can generate additional income. Both studies revealed the different chain flows by which fuelwood moves from the producer to end consumers, with much more complex flows found by Puentes-Rodriguez et al. [15], and shorter value chains in which a single actor performs all activities from harvesting to trading and selling [11]. These differences are because the actors originate from two different groups recognized as formal (bearing longer chains) [11] and informal groups (with shorter generic chains) [11;15].

However, [9] studied only informal fuelwood actors while [15] studied both formal and informal actors. Findings from the two studies indicate that the activities of informal actors negatively influence fuelwood prices as the actors are independent in terms of their actions along the value chain and can source, transport, and trade the product unsustainably with no or less capital investment expenditure and therefore, establish prices freely as deemed appropriate. This uncontrolled exploitation of forest resources by informal actors has led to the decline of the forest [11; 15].

Within this context, there has been little understanding on the overall structure and characteristics of the fuelwood value chain in Nigeria. Although fuelwood is the dominant energy source in Nigeria, the fuelwood industry, however, has not received the policy attention it deserves [4,5]. This may be partly due to the lack of information and supportive data on the nature of the fuelwood supply chain, especially on how the resources are sourced, produced and distributed to end consumers as well as the actors involved and their role in the value chain. A basic understanding of the value chain can enable

policy makers to formulate a sound policy and interventions program tailored to the needs of the industry while contributing to more sustainable socioeconomic development. Therefore, this study aims to uncover the structure and characteristics of the fuelwood value chain in Northern Nigeria using Yobe State as a case study. The objectives of the study are to identify the sources of fuelwood production, develop a fuelwood value chain map and identify the actors in the fuelwood value chain and their roles.

2. Methodology

2.1. Study area

The study area is the Yobe State of Nigeria (Figure 1a). It has 17 local government areas distributed across three geopolitical regions (Figure 1b). The division of the state into three zones (I, II, and III) are for administrative convenience but also reflect some differences in characteristics in terms of vegetation. The northern part of Yobe (Zone III) lies within the Sahel belt and receives three months of rainfall of less than 500mm annually while the southern part (Zone II) and to some extent, the greater part of the eastern zone (Zone I) lies in the Sudan Savannah with denser vegetation and a higher amount of rainfall (713mm) and five months of rainfall [16]. Three major towns, based on their dependency and high demand for fuelwood, were purposefully considered for this study: Bade (B), Damaturu (D), and Potiskum (P).
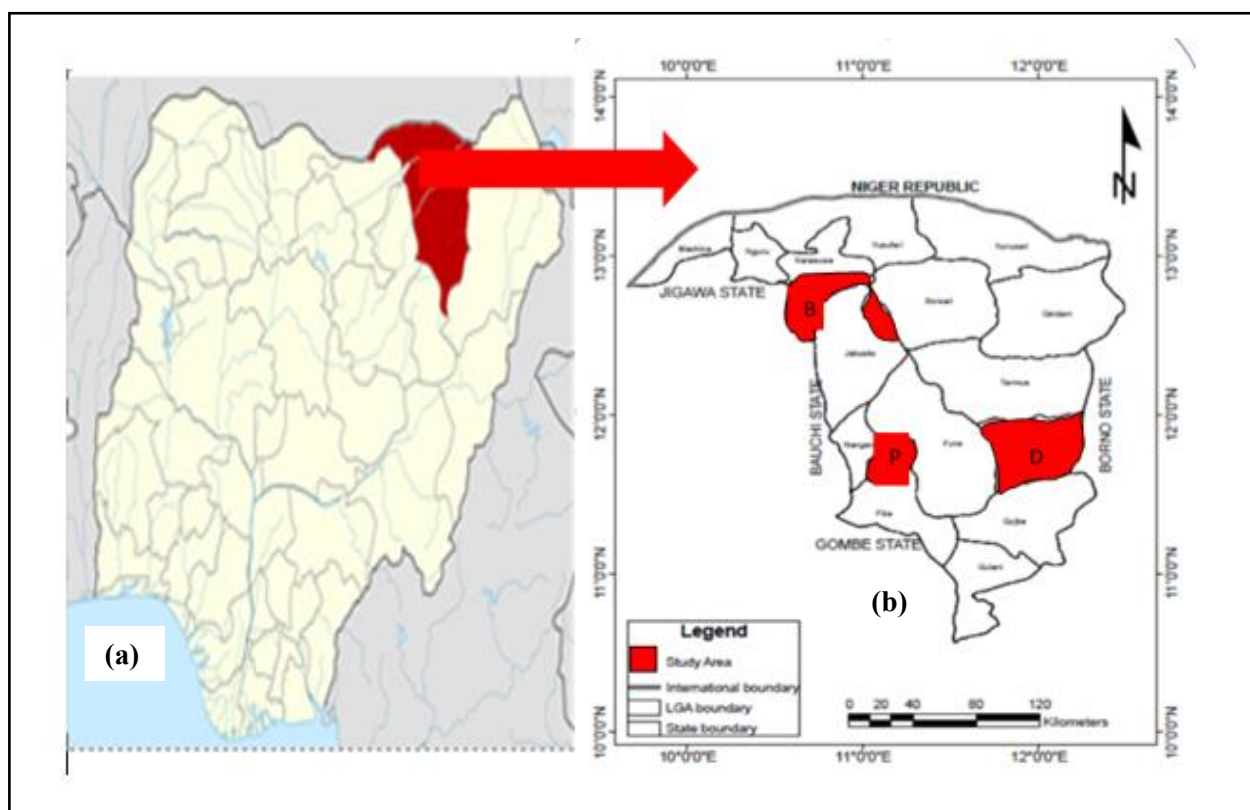

Figure 1. a) Map of Nigeria showing the location of Yobe. **b)** Map of Yobe State showing the three geopolitical zones. (Source: Adapted from [16])

2.2. Data collection and analysis

Primary data were collected from June to September 2018 using direct observations, group discussions, and the interviews of key informants. An open-ended questionnaire was used to collect

data from a total of 49 participants (Table 1). Due to the sensitivity of the fuelwood business, the participants for the survey were selected opportunistically [9;11]. Secondary data were gathered from state government records as well as scholarly journals. Content analysis was used to analyze the data. Table 1 shows the methods, respondents, sample size, and types of data collected in this study.

Table 1: Method of data collection, survey participants, sample size and types of data collected.

Method	Survey participant	Sample size	Type of data collected
Interview	Government officials	10	Classification and roles of zonal and local government forestry offices, identification of formal acceptable sites of fuelwood collection, and the status of forest officials in the fuelwood value chain in the state.
Interview	Informal fuelwood suppliers	9	Sources of fuelwood, components of the value chain, identification of actors and roles in fuelwood value chain.
Focus group discussion	Representatives of licensed fuelwood industry (the fuelwood traders and lumberjacks association) and representatives of special services providers in the special fuelwood market of the respective town	30	Sources of fuelwood, components of the value chain, identification of levels of operations and roles of actors

3. Results and Discussion

3.1 Sources of fuelwood in Yobe, Nigeria

Fuelwood, the study revealed, was typically collected and/or harvested from various places including natural forests (forest reserves and communal forest areas), farmlands, bushes, urban forests, and buffer zones of National Park. However, forest reserves and communal forest areas (CFAs) were the only sources recognized as legal commercial fuelwood collection and/or harvesting sites (Table 2). Forest reserves are gazetted forest areas managed by the state forestry department. Small-scale and large-scale fuelwood harvesters can obtain a license to harvest fuelwood in the forest on a rotational basis. Conversely, CFAs are woodlands surrounded or neighbored by one or more community(ies) and households residing in the community; therefore, small-scale harvesters need to ask for permission from the community leader (usually a traditional head of the nearest forest community) to collect and/or harvest fuelwood from the CFAs.

Apart from the legal (licensed and community-leader-approved) fuelwood harvesters, illegal fuelwood harvesters were found to be involved in exploiting both forest reserves and CFAs as well as other sources for fuelwood. The presence of illegal fuelwood harvesters in Nigeria is a result of some factors including weak forest policies and governance, a high demand for fuelwood from the increasing population due to the lack of affordable energy sources that discourage people from switching to modern energy sources [4,9] and corruption [2;3]. As noted by [9;13], illegal fuelwood extraction leads to uncontrolled forest extraction and hence, deforestation and forest degradation. The finding of this study, therefore, confirms the work of [11;15] on the existence of informal actors and the impact of their activities as well as agree with the findings [11] on the presence of formal actors and their activities being sustainable in the fuelwood value chain.

Table 2: Forest reserves and communal forest areas in Yobe State, Nigeria.

No.	Names	Type	Location	No.	Names	Type	Location
1	Bam Ngelzarma	FR	Geidam	15	Kalalawa forest reserve	FR	Damaturu
2	Chingurmi Duguma	FR	Bade	16	Kilboa forest reserve	FR	Yusufari
3	Damaturu, forest	FR	Damaturu	17	Kubulu-Sugum	FR	Jakusko
4	Damasa	FR	Jakusko	18	Kumadugu-gana reserve	FR	Potiskum
5	Dusuwa forest	FR	Damaturu	19	Kumaganan forest	FR	Yusufari
6	Galamo forest	FR	Potiskum	20	Kurkushe	FR	Jakusko
7	Gundulwa forest	FR	Damaturu	21	Machina forest reserve	FR	Machina
8	Gudi forest	FR	Fika	22	Male/Chana reserve	FR	Potiskum
9	Gujba forest	FR	Gujba	23	Zurgum Baderi	FR	Jakusko
10	Wagur forest	FR	Gujba	24	Burai	CFA	Potiskum
11	Gumsi forest	FR	Gujba	25	Zayi	CFA	Potiskum
12	Gwayo forest	FR	Jakusko	26	Babale	CFA	Potiskum
13	Gorgaram	FR	Jakusko	27	Bam-Bautukum	CFA	Potiskum
14	Jajeri forest	FR	Fune	28	Kukuri	CFA	Potiskum

Note: FR: forest reserve, CFAs: communal forest areas (Source: Authors' study)

3.2 Fuelwood value chain map in Yobe; actors, and their roles

Based on the collected information, the generic fuelwood value chain in Yobe is presented in Figure 2a. The functions begin from the fuelwood sources, followed by harvesting, transport, trading, retailing and, lastly, consumption. The value chain chart created in this study is an adaptation of the value chain created by [11]. Further analysis revealed five sub-chains grouped into either formal or informal (Figure 2b). The formal chain is characterized by the actors who were licensed and registered with related associations, whereas informal chain actors were unlicensed and did not belong to any associations [11].
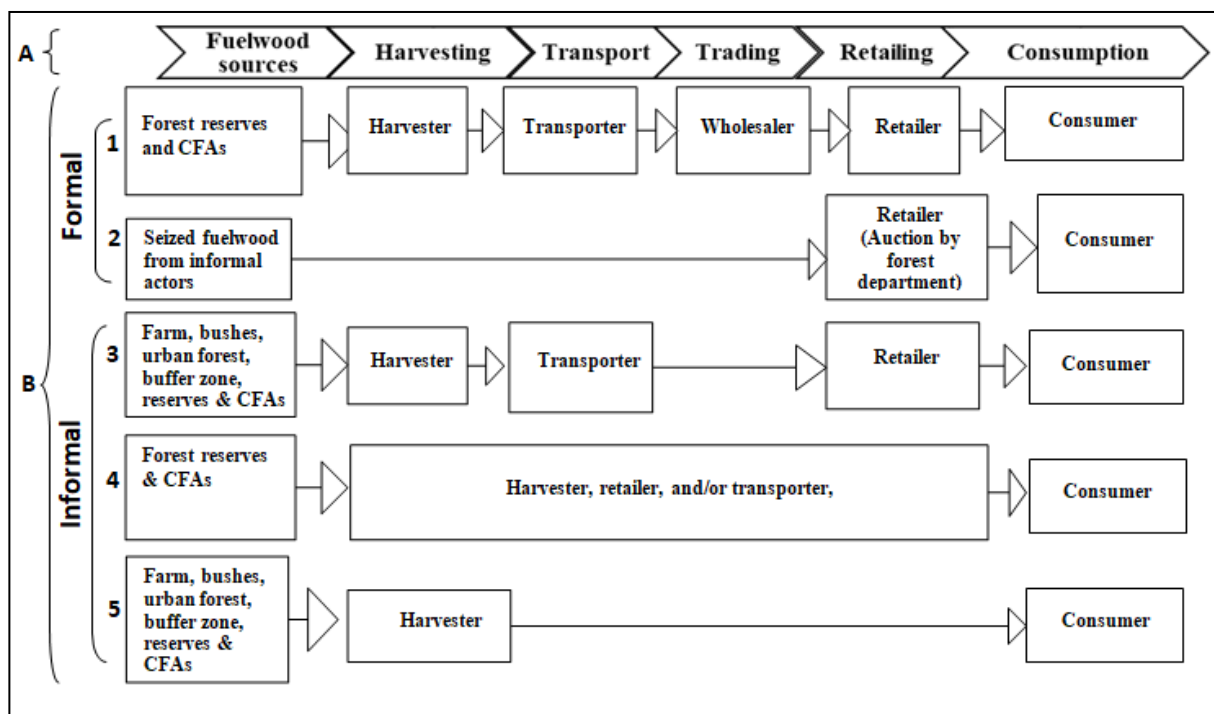

Figure 2: a) Generic fuelwood value chain chart. b) Fuelwood value chain chart with formal and informal actors in each function

For the formal chain 1, the functions followed the generic fuelwood value chain and the actors involved are harvesters, transporters, wholesalers, retailers, and consumers. All the actors in this chain were licensed, large-scale, and permanently involved in fuelwood businesses. The sources of harvesting in this chain were limited to forest reserves and CFAs. The transporters used large trucks to haul fuelwood from sources to the market. The wholesalers purchased the fuelwood from the harvesters at the special fuelwood market and then compiled the fuelwood into specific sizeable volumes for the retailers to buy. After the fuelwood was bought from the wholesalers, the retailers employed workers to cleave the wood (logs) manually into ideal fuelwood sizes, which are then bundled for sale to consumers. The formal chain 2, however, is shorter since it starts from the retailing function and ends at consumption. The retailers or actors in chain 2 were the state forest department, who auctioned all of the seized fuelwood to consumers from the unlicensed or illegal actors found during monitoring activities that are conducted weekly.

Unlicensed actors comprising harvesters, transporters, retailers and, lastly, consumers, occupy the informal value chain 3. Harvesting was carried out by individuals or families who fell trees from various sources, mainly from forest reserves or CFAs. The harvesters then hired truck services to deliver the fuelwood to retailers and sold the fuelwood themselves to the retailers. The retailers in turn employed the service of manual woodchopper to cleave the logs, prior to bundling and sales.

In the informal value chain 4, CFAs are the main source of supply for its actors though it is not limited to other sources. This chain involves small-scale and individual fuelwood harvesters, from rural or urban areas, who harvest, trade, and occasionally transport their own fuelwood. Therefore, there is an integration of functions in this value chain with harvesting, retailing, and transporting being undertaken by a single actor. Fuelwood in this chain is harvested, cleaved, and bundled at the harvesting site. At times, harvesters would hire transport services using modern transportation, such as a small truck, for a specific hour (e.g., 9:00 am to 5:00 pm) to a specific town. As the transporter slowly hauled the bundled fuelwood to the target market (usually an urban area), the harvester would sell the fuelwood along the streets. Typically, harvesters sit on the fuelwood bundles carried by the truck and loudly yells to attract the customers' attention using local phrases such as 'Yobe Yobe', 'Jaka-jaka', and 'Jaka da Yobe'; which correspond to "fifty-fifty", "two hundred-two hundred", and "two hundred and fifty Naira" (₦50, ₦200, and ₦250), respectively, corresponding to the amounts in Nigeria currency called Naira (₦) for the different fuelwood bundles available for potential customers. The harvester shouts while watching for potential customers and signals the driver of the truck to stop whenever a customer is sighted. This process continues until the contract service time period expires. Some harvesters in this chain use their own or the family's traditional means of conveying goods such as donkeys, ox-carts, and camels.

Value chain 5 includes only two functions: harvesting and consumption. In this chain, the harvesters are from urban or rural households. They often collect fuelwood from their farms, bushes, and other nearby sources, which are not always necessarily within walking distance for their own use (cooking and heating). Both men and women, as well as the children of the household, collect fuelwood. To bring this small quantity of fuelwood to their houses they usually carry it by hand or use other affordable and available means of transport such as bicycles, rickshaw tricycles, donkeys, oxen, cows, wheelbarrows, or any available commercial transport.

The results of value chain 3–5 of the informal chain have shown that the informal actors are neither registered actors nor members of any business association and therefore, they lack a leader or body who can give instructions or directives on appropriate practices in the supply chain. Thus, these actors are independent in terms of harvesting; trading and pricing practices, which in turn have been negatively influencing the sources of fuelwood (e.g. forest) and the fuelwood market (e.g. price fluctuating). These groups (value chain 3–5) need to be formalized through the enforcement and implementation of a compulsory licensing policy that requires all actors to provide detailed personal information and to understand and sign a regulatory document. Documentation can also provide opportunities for business-related partners (e.g. educational and research institutions, international organizations, etc.), to be able to access actors' information through the forest authority and easily

connect for technical support that can improve practices and address other challenges affecting the entire value chain; while recognizing environmental and other policies related to all functions in the fuelwood value chain. For example, business partners, such as commercial banks, can help in injecting the necessary cash (micro-credit to assist poor actors,) while government and research institutions can assist in accelerating the adoption of technology (initiating training workshop for the actors on sustainable practices in growing trees, harvesting, cleaving, weighing and bundling to add value, transportation, storage, marketing technologies). Similarly, formalization of the actors in the value chain 3–5 can help the government to design and implement tax structures that would include all actors along the fuelwood value chain based on their income.

4. Conclusion

This study reveals the characteristics of the fuelwood value chain in Yobe, Nigeria. The primary sources of fuelwood are forest reserves and open natural forests or CFAs. Both licensed and unlicensed fuelwood harvesters patronize the areas for their own consumption or commercial use, causing additional pressure on the forest resources. Other sources of fuelwood include bushes, farmlands, urban forest, and buffer zones of national parks. The study identified a generic fuelwood value chain consisting of five functional phases: harvesting, transporting, wholesaling, retailing, and consumption. In addition, five sub-chains were recognized based on formality (formal and informal actors). Formal actors were usually licensed and registered members of fuelwood organizations while the informal actors were not. The intrusion of informal actors on the fuelwood value chain have resulted in increased pressure on forest resources and consequently, on the environment due to unsustainable practices from production to end consumption functions. Thus, this needs to be properly addressed by the government through measures that include an efficient and flexible licensing system, implementation of fuelwood regulations, active monitoring, increased awareness on benefits (e.g. job security, profits and sustaining the forest) associated with licensing and acting as a registered member of an organized business group, and the improved supervision of the forest laws' enforcement agents to curtail corruption. Although this study has uncovered the basic structure and characteristics of the fuelwood value chain in Yobe, further research is needed to consider the various elements, such as economic, social, legal, and environmental ones, to fully understand the fuelwood value chain.

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