Assessment of Geospatial Distribution of Sawmills in Ife-East Local Government Area, Osun State, Nigeria

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ABSTRACT: Generally, in Nigeria, there is a problem of inadequate collection of data and information, particularly in forestry, which poses a severe threat to the effective management and sustainability of forest and forest resources. Hence, the objective of this paper is to assess the geospatial distribution of sawmills in Ife-East Local Government Area, Osun State, Nigeria, using a Geographic Information System and a semi-structured questionnaire administered to 67 sawmills. Data obtained shows that the type of machines used in sawmills were predominantly CD6 and circular saws (67.16%), while a few others use CD-6 (28.36%) and CD-6, shaping machines and circular saws (4.38%). The results also revealed that there has been a drastic decrease in the sawmill industry from 94 to 67. The research findings from this study are adequate to help investors in the wood industry determine the location, type of machines used for log conversion and mode of operations.

In a wood-based industry, logs are obtained from the forest and converted into planks (semi-finished products). The primary wood-based industry in Nigeria is sawmills since every other wood industry that depends on the forest as a source of raw materials has folded up (Alo, 2017). Sawmilling is one of the principal forest and wood-based industries involved in processing and efficiently utilizing forest resources (timber) and producing semi-finished intermediate wood products for other sectors (Ekpe, 2011). Before using timber, it must first be processed in the sawmill. The sawmill deals with the conversion of exploited round logs into planks. The natural high forest zone is a source of procurement of round logs used by sawmills in Nigeria. These areas are mainly the southern parts of the country, which include Cross-Rivers, Edo, Ogun, Ondo, Ekiti, Oyo, Osun and Delta states, which makes them have the highest concentration of sawmills in Nigeria (Bello and Mijinyawa, 2010). Alo *et al*. (2014) reported that information gathered on the Nigeria Forest Information System (NFIS) website in the study area was very scanty, where only the names of the sawmills were made available and nothing else. The Sawmill Information System (SIS) was developed by the Forestry Department Peninsular Malaysia using the Microsoft Access Database software. It runs on the Microsoft Windows 95/98 operating system. The SIS was used to capture data gathered through all the Sawmills in Peninsular Malaysia (Poh *et al.,* 2001). Geographic Information System (GIS) focuses on the processes and methods that are used to sample,

represent, manipulate and present information about the world. GIS is a system that includes Data collection (using GPS and paper maps), storage, processing and analysis and output production, which is the displayed content. It combines database, mapping and statistical methods to integrate georeferenced data into visual displays. GIS is applied as a management and decision-making tool in the sawmill industry to record and monitor the changes that occur to the sawmills over time. Sawmilling activities in most lumber mills could generate an appreciable amount of noise due to the machining activities that occur daily for a long time (Aremu *et al*. 2015). Like every other business, sawmilling businesses also have some peculiar challenges. The immediate problems facing the sawmill industry are frequent instability of electricity supply, obsolete equipment and the severe shortage of spare parts, reduction in the volume of timber supply, size and logs quality, illegal felling and insecurity of tenure concerning timber concession (Aruofor, 2000).

Generally, in Nigeria, there is a problem of inadequate collection of data and information, particularly in forestry, which poses a severe threat to the effective management and sustainability of forest and forest resources. This lack of information makes it difficult to enact laws that promote and encourage forestry in the country. In most cases where the data are available, they are obsolete, incomplete or incorrect (Alo and Akindele, 2011). The latest maps showing the distribution of sawmills across Ife East Local Government Area are unavailable. This research aims to bridge the gap by making available information about the spatial distribution and contents of sawmills across the study area. Hence, the objective of this paper is to assess the geospatial distribution of sawmills in Ife East Local Government Area, Osun State, Nigeria.

MATERIALS AND METHOD

The Study Area: Osun state is an inland state in southwestern Nigeria. Its capital is Oshogbo. It is bounded in the north by Kwara State, in the east partly by Ekiti State and partly by Ondo State, in the south by Ogun State and the west by Oyo State. The state has a total area of 9,251 km^2 and a population of 2,416,959 as of 2006. Osun state has 30 local government areas, including Ife-East. Its headquarters is in Oke Igbo. It has a total land area of 172 km^2 and a population of 188,087 from the 2006 census. The postal code of the area is 220. Fig. 1 presents the map of Osun State, showing the states surrounding it.
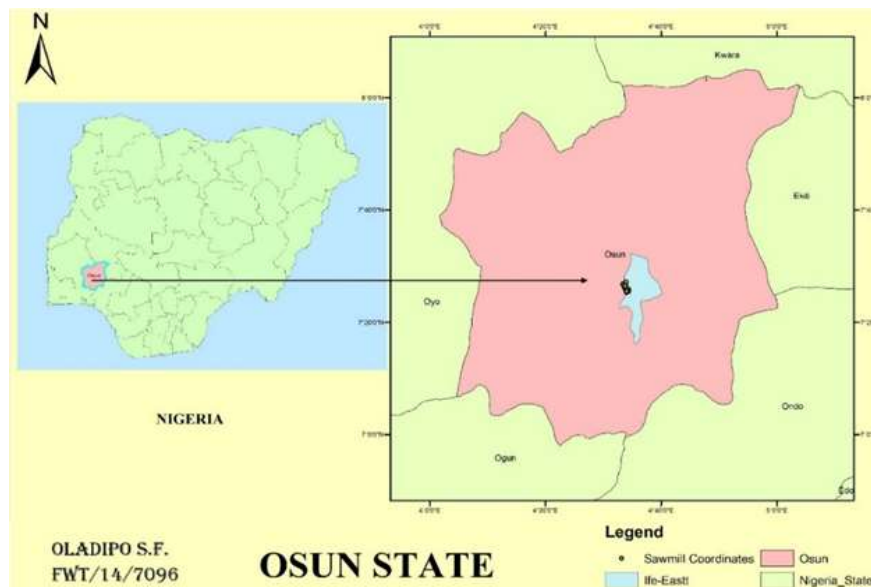
Fig 1: Map of Osun State. Source: Field Survey, 2019

Data Collection and Analysis: Two sources of data (primary and secondary data) were obtained during the study. The primary data comprises the administration of questionnaires to sawmill owners and using GPS to acquire the coordinates of sawmills in the sampled area. Conversely, the secondary data was obtained from the Osun State Ministry of Environment headquarters at Osogbo, Osun State capital. The secondary data includes the list and locations of sawmills across the study area. Coordinates of various sawmills in the study area were collected using an Android app called MyGpsCoordinate. ArcGIS software was used to analyze data in this research. For

analysis of the data, SPSS, ArcMap, Google Earth Pro and Microsoft Excel were employed.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Respondents: The socioeconomic characteristics of respondents (Table 1) revealed significant distinctions in gender, indigene-ship, marital status, religion, and education levels. The empirical findings show that 95.5% of respondents were male, while the remaining 4.5% were female. The indigene status distribution shows that 49.3% of respondents were indigenes of Ife, while 50.7% were non-indigenes. The marital status distribution revealed that 6% of the respondents were single, and the other 94% were married. The distribution of educational level showed that the maximum level of education attained by 16.4% of the

respondents was primary school, 35.8% attended secondary school, 41.8% attained a tertiary level, and the other 6% had no formal education. 38.8% of the respondents were Christians, while the other 61.2% were of the Islamic religion.

The sawmill owners' prevailing annual income in naira was 2,000,000-3,999,999 (37.3%), followed by 19.4% who earned 4000000-5,999,999 annually. 11.9% of the respondents earned 6,000,000-7,999,999 and 8,000,000 respectively. The least income earned by the sawmill owners is 2,000,000 (19.4%). Furthermore, the most active age groups in the sawmilling industry are 41-50 and 51-60, with a percentage of 25%, respectively. This was followed by people between the ages of 31-40 with a percentage of 19.4%. The least age group participating in sawmilling activities are those below thirty years (11.9%).

Table 1: Socioeconomic Characteristics of Respondents

| Criteria	Variable	Frequency	Percentage (%)
Gender	Male	64	95.5
	Female	3	4.5
	Total	**67**	**100**
Ife Indigene	Yes	33	49.3
	No	34	50.7
	Total	**67**	**100**
Marital Status	Single	4	6.0
	Married	63	94.0
	Total	**67**	**100**
Education Level	No Formal Education	4	6.0
	Primary Education	11	16.4
	Secondary Education	24	35.8
	Tertiary Education	28	41.8
	Total	**67**	**100**
Religion	Christianity	26	38.8
	Islam	41	61.2
	Total	**67**	**100**
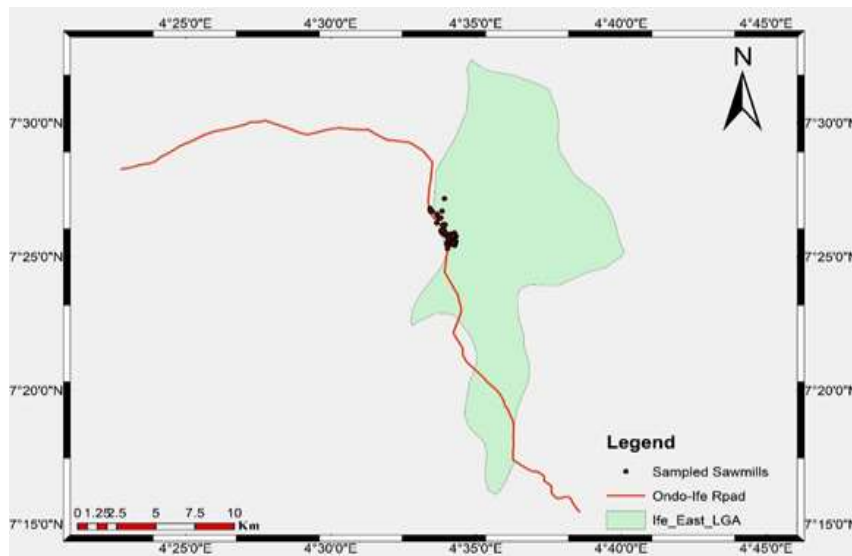
Fig 2: A Map showing the Distribution of Sawmills in Ife-East LGA. Source: Field Survey, 2019

Spatial Attributes of Sawmills: A total of 67 sawmills were sampled in the study area, compared to the 94 retrieved from the secondary source. The sawmills were evenly distributed on both sides of the road (Fig. 2). Furthermore, our findings show that the oldest sawmill was Divine Favor, established in 1988, with the respondent having 20 years of experience. The sawmill was second to the Alubarika sawmill in terms of the number of workers. On the other hand, the most recently established sawmill is God's Power sawmill, which was established in 2015. Oluwatoyin sawmill, Ayeloja sawmill, and Dejimania sawmill had four workers, respectively, which was the lowest number of workers. The sawmill with the highest number of workers was the Alubarika sawmill, which had fourteen workers. The sawmill establishment in Ife-East Local Government Area had decreased over the years. The study shows that 31 (46.27%) were established between 2006-2011. However, there hasn't been any sawmill establishment recently in the last two years. Sawmill establishment was at its maximum between 2006 and 2011 and its minimum between 1988 and 1993. The prevailing years of experience of respondents were 6-19 years (29.85%), years of experience of 11-15 (20.90%) years and 16-20 (20.90%). The least years of experience of respondents with sawmilling experience was between 26-30 (1.49%).

Non-Spatial Sawmills Attributes: Common Tree Species Processed in The Study Area: Table 3 shows the list of common tree species processed at sawmills in Ife-East Local Government Area, Osun State. The abundance of these species suggests that they are either more accessible or preferred due to their desirable wood properties. This preference may be driven by wood strength, durability, and workability, essential for various woodworking applications.

Table 2: List of Common Tree Species Processed

Botanical Name	Common Name	Family
Albizia zygia	Ayunre	Leguminosae
Ceiba petandra	Araba	Bombaceae
Sterculia rhinopetala	Koko Igbo	Sterculiaceae
Alstonia bonnie	Ahun	Apocynaceae
Gmelina arborea	Gmelina	Lamiaceae
Khaya ivorensis	Mahogany	Meliaceae
Celtis zenkeri	Ita	Cannabaceae
Mansonia altissima	Mansonia	Malvaceae
Milicia excelia	Iroko	Moraceae
Corton penduliflouris	Eru	Euphorbiaceae
Cordia milleni	Omo	Bignoniaceae
Irvingia grandifolia	Karakoro	Irvingiaceae
Liriodendron tulipifera	White-wood	Magnoliaceae

Source: Field Survey, 2019

Sawmill Activities: All the sawmill owners in the study area were members of the sawmillers association, leaving no one behind. This association allows members to air their views about their business, contributions, and agreements on specific issues. The sawmill owners in the study area use a common power source: a generator and IBEDC. The standard method of waste disposal was burning, which was practised by all saw millers. The dimensions of sawn timbers processed in these sawmills were 1×12, 2×12, 3×4,2×2×12, 2×4×12, 3×4×12 and 12ft. The business ownership was sole proprietorship. However, many were associated with other industries, such as the plank market and furniture-making industries. The study shows the machine maintenance duration of the sawmills. 29.85% of the sawmills maintain their machine daily, 44.78% on weekly basics, and the last 25.37% maintain their machine monthly. The maintenance operations include oiling and greasing the required parts of the machines where there's a remarkable level of friction. Other duties include cleaning and dusting away sawn particles. There was a high level of land/sawmill premises ownership by the sawmill owners (83.58%), and the other 16.42% of respondents rent the land area for their business. Most (83.58%) of the respondents ventured into the industry due to high profit, while 16.42% opined that their motivation was the successful individual records of past sawmill owners. In addition, 80.6% of the respondents sold their products locally across Nigeria. Some sawmill owners had customers from foreign countries, making them sell their products locally and internationally. 19.4% of the respondents belonged to this category. However, no sawmill owners sell their products only to the international market. Apart from sawmilling, 89.55% of sawmill owners had associated plank industries, while 4.46% were into furniture making, and 5.97% had no industry associated with the sawmill. The prevailing machines used by sawmillers was the CD-6 machines that were used simultaneously with the Circular saw with a percentage of 67.16%. This was followed by the CD-6 machines, the only machine used by 28.36% of the sawmill owners. The least used category of machines was the CD-6 machine, shaping machine and circular saw (4.48%). In addition, sawmill owners acquired capital from various sources to start their businesses. The study further revealed that 43.28% of respondents obtained their capital from loans, 20.89% from friends and family, 11.94% from cooperative societies, 28.35% from savings and only 1.49% from government loans. However, some saw millers obtained their capital from only two sources. The highest source of capital for the sawmill business was procurement of loans (43%), while the lowest source was from the government (1.49%). Three respondents obtained their logs from free areas; only one sawmill obtained logs from the plantation. Meanwhile, those

who got their logs from free areas and private plantations were not limited to these areas alone but also obtained logs from government reserves. The retailers were the majority of sawmill product distribution (50.74%), followed by the wholesalers (46.26%) and the direct users (10.44%). The carpenter is a typical example of a direct consumer. Like every other business, sawmillers also experienced several challenges. The result obtained shows that the prevailing challenges faced by the sawmill owners were seasonal changes (58.2%), scarcity of forest resources (38.8%) and transportation cost (34.3%). Other challenges include government policy and inadequate funds. The last challenge experienced was the lack of a constant supply of electricity due to the availability of multiple sources of electricity.

Conclusion: The study revealed that GIS is a powerful tool for managing spatial and non-spatial information related to sawmills. Based on the results obtained from this study, 67 sawmills were identified and sampled, indicating a decline in the sawmill industry. The result of this study is adequate to support stakeholders and policymakers in the wood industry in determining the location, type of machines used for log conversion, and mode of operations. Future research may consider collaboration among the sawmill industry, local stakeholders and the government where afforestation and reforestation programs would be implemented.

Declaration of Conflict of Interest: The authors declare no conflict of interest.

Data Availability Statement: Data are available upon request from the corresponding author

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