ECONOMIC ANALYSIS OF SAWMILL INDUSTRY IN ONDO STATE

By

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ABSTRACT

The study looked at the economic analysis of sawmill industry in Ondo State under three scale enterprises namely: small, medium and large. The study examined the socio economic characteristics of the sawmill operators and the comparative profitability analysis of the sawmills. It also investigated the productivity of the resources used with reference to elasticity of production and returns to scale. And finally, it examined the marketing channels for sawmill products in Ondo State.

Data were collected from 86 sawmillers in six Local Government Area of Ondo State, using sructured questionnaire, administered on respondents selected using simple random sampling technique. The data collected were analysed using descriptive statistics, budgetary analysis and production function analysis.

The result showed that sawmill operation is profitable in Ondo State.

The production function analysis shows that log for processing and labour were the most important factors in sawmill operations.

Education, and experience had negative signs on their coefficients as against a priori expectation.

The study thus recommends that educated sawmillers should pay more attention to the supervision of the sawmilling operations. Medium and large-scale enterprises should watch their cost structure to reduce areas of waste while small and medium enterprises should expand their operation to make efficient use of labour available to them.

CERTIFICATION

This is to certify that this thesis was carried out by Mr. Obalokun, Babatunde Michael under my supervision.

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Prof. P.B.Imoudu
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DEDICATION

This project work is dedicated to the Glory of GOD ALMIGHTY for his goodness, mercies and protection over my life, my family and for His guidance in making this project work a reality.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 IMPORTANCE OF FORESTRY IN THE NIGERIA ECONOMY

The forestry sub-sector of Nigerian economy had been in the fore-front in the areas of providing the much needed raw materials for the agro-based industries in Nigeria.

The crucial role of forestry in the overall economic development of Nigeria includes provision of employment opportunities for forest workers such as forest guards, forest officers, logging [truck] drivers and power chain operators to mention a few. It has great potentials for exportation of several thousands of cubic metres of wood for the realization of foreign exchange for capital formation, the forest also provides raw materials for the agro-based industries and non-timber products like rope, bush meat and medicinal herbs.

Furthermore, the forest is important in the wildlife conservation, control of soil erosion through the binding action of the tree roots on soil, maintenance of the eco-system, prevention of desert encroachment and reclamation of land through afforestation.

However, the world's yearly consumption of wood by man was estimated to be about 2,500million cubic metres out of which a staggering forty six percent (46%) is burnt next to the felling site (Kai, 1981). Following high exploitation rate of the forest in excess of the rate of regeneration, the raw material base of the wood industry had seriously been depleted.

Even the high forest zone of the country with its rich floristic composition has reduced drastically due to population pressure, which has converted such zones to residential and industrial uses.

Moreover, the savanna zone supplies very little timber though they are important source of poles, fuel wood and many other non-wood forest products.

According to a study conducted by Geomatics International Incorporated in Canada (1993), there was a significant drop in the total areas occupied by the high

orest as shown in Table 1. The study showed that between 1976 and 1995, there has een a decrease of 11,254km^2 in the total area of high forest. During the same period a ecrease of 90,593km^2 was also recorded in the Savanna zone.

Moreover, most of the forests, like the Savanna woodlands are scattered in vast eas with different trees species. The quality of log obtained from this forest is rather w due to many knots (uneven surfaces on the log) and fire damages.

As a result of the decrease in the raw material base of wood industries, some of e sawmills are now bedeviled with problem of obtaining desired species and now lying on small diameter logs for operation.

According to the same report, it was stated that the effect of the dwindling forest source base was also expected to affect the supply of poles whose short supply was pected to rise from 0.8 million cubic metres in 1995 to 2.3million cubic metres by e year 2010.

As a result of all these inadequacies, majority of the wood-based industries such the sawmill have been forced to operate on one shift and also below installed pacity.

In order to strike a balance between supply and demand for wood and its oducts, it is necessary to embark on vigorous afforestation and improve on the nagement practices of forest resources as well as increase capacity utilization of y materials in wood industries.

Table 1: Vegetation Changes in Nigeria between 1976/78 and 1993/95

Vegetation Type	Area in 1976/78 (KM^2)	Area in 1993/95 (Km^2)	Change (Km^2)
Mangrove Forest	9994	9977	-17
Forested Fresh Water Swamp	18316	16499	-1817
Lowland Rainforest	40524	31104	-9420
Riparian Forest	7402	5254	-2148
Savannas	284893	194300	-90593
Total	361129	257134	-103995

Source: (1) Geomatics International Inc., Canada (1993)

1.2 WOOD REQUIREMENTS OF SAWMILL INDUSTRY IN NIGERIA

The forest is a renewable resource, which provides a wide range of materials for the use of mankind.

The materials derivable from the forest have led to the establishment of some industries that have contributed immensely to the improvement of human welfare (Adeyoju, 1965). Some of such industries include plywood industry, pulp and paper industry, sawmill industry and the veneer industry.

Notable among these industries is the sawmill industry. In a survey conducted by Adeyoju (1975), it was reported that out of all the wood industries, the sawmill industry is the largest consumer of wood. In a related research conducted by Akindele and Fuwape (1998), it was reported that the volume of wood required by sawmill in Nigeria tops the list of the wood requirement of agro-based industries with the exception of fuel wood and utility wood. Table 2 shows that the volume of wood required by sawmill was 6182 thousand cubic metres in 1993, 7558 thousand cubic metres in the year 2000. It was further estimated that by the year 2010, the volume of wood needed by the sawmill will be about 10935 thousand cubic metres.

1.3 RELEVANCE OF SAWMILL INDUSTRY IN ONDO STATE

Since the creation of Ondo State in 1976, there has been an increase in the demand for wood as a result of the constructional development in the areas of building, engineering, furniture and road construction among others. All these activities depend very much on wood. The increase in demand for wood and its products has led to the sporadic upsurge in the number of sawmills in the state.

Before the creation of the state, the number of sawmill operating in the state was put at between 120 to 125 (Sekene, 1989). But by 1997 the number of sawmill was about 262 (Akindele and Fuwape, 1998). Sawmill is regarded as the first mechanical processing of wood conversion. The product are generally regarded as semi-finished products as they serve as raw materials for other wood processing industries.

Table 2: Revised Wood Requirement in Nigeria ('000m^3)

Products	1993	2000	2010
Fuel wood	103474	128495	156634
Utility wood	2514	2874	3441
Saw logs	6182	7558	10395
Veneer logs	618	618	618
Particle board	69	111	460
Pulp wood	35	35	35
Total	112896	139695	172127

Source; Akindele and Fuwape (1998)

1.4 PROBLEM FACING THE SAWMILL INDUSTRY IN NIGERIA

The Nigerian forestry sub-sector is faced with lack of infrastructures like good road network for proper transportation of raw materials (logs) from the forest to the mill site. The sawmill industry is faced with acute shortage of wood raw materials due to the activities of illegal fellers and wanton destruction of forest resources. The dwindling forest resource base has resulted in scarcity of desirable tree species such that some of the mills have resorted to using under sized log (small diameter logs) for operation.

The use of undersized logs in the mill results into high volume of wood waste such as sawdust, slabs and off-cuts noticeable in the sawmills. Moreover, many useful time is wasted on the conversion of such small-sized logs resulting in many down time which slows down production activities.

Other problems militating against the industrial development of the sawmill in Nigeria is the absence of proper equipment such as conveyors to handle logs between machines, lack of trained labour resulting in poor sawing techniques with the attendant wood waste, absence of occupational safety materials to reduce health hazard of workers, poor location of mill and inadequate knowledge of timber marketing and market prices.

1.5 PROBLEM STATEMENT

The sawmill industry is the pivot on which the activities of other wood industries revolve. It processes about 96.62% of the total volume of wood cut in the country and its contribution to the **GDP** surpasses that from other subsectors of the wood based industries (Adeyoju, 1975). Inspite of the significance of the industry, the sawmill industry is controlled by the small scale,low income operators who could not provide most of the essential facilities needed for efficient performance of the industry.

This study therefore looks at the production performance of the sawmill industry under three types of scales - small, medium and large with a view to identifying the most efficient (economically and technically) and the effects of the production parameters on the performance of the industry.

Findings from the study would be used as basis to advise both the government nd the operators of the sawmill industry on the most efficient scale of operation to dopt and the proper allocation and utilization of the factors of production employed the sawmill industry.

.6 OBJECTIVES OF THE STUDY

The major objective of this study is to undertake an economic analysis of wmill industries under three scales (small, medium and large) in Ondo State.

In order to achieve this broad objective, the study has the following specific bjectives:

To examine the socio-economic characteristics of sawmillers under the three scale economies

To estimate and compare the profitability of sawmill operations under small, medium and large scale economies.

To examine the productivities of the sawmills on the basis of elasticity of production and returns to scale, and.

To examine the marketing channels for timber in the state.

7 LIMITATION OF THE STUDY

During the conduct of the study, there was the problem of standard unit used by sawmillers in estimating the volume of wood processed. The old cubical easurement such as inches and feet were in use. These units of measurement had to converted to cubic metres (m^3).

The sawmillers kept no accurate records of their economic activities. Reliance to be put on information supplied from memory, therefore some of the ormation supplied could not be substantiated.

Also, at the state forestry Department, some of the information required on the ual number of sawmills as well as the estimates of current production figures could be obtained as such records are not available.

It was difficult to get information from some of the operators as they did not see any immediate benefit in giving audience to anybody that does not come for business transactions.

In addition, more time was wasted in persuading and convincing some of them who showed uncooperative attitude when asked to give information regarding some aspects of their business. They thought that the questionaire was designed to gather more information from them which may result in heavy taxation and other levies from the government.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 HISTORICAL BACKGROUND OF THE SAWMILL INDUSTRY IN NIGERIA.

In the olden days, when sawmill equipment had not been invented, the splitting of wood was done with the aid of crude implements like axes and wedges.

The rest of the wood were left in the forest to be used as fuel wood. However with the arrival of Portugues in the country in 1783, the old method of wood extraction gave way to pit sawing method (Okigbo,1964).

The method of pit sawing involved laying of logs in pits and cutting them with cutlasses. The pit sawing method was replaced by powered saw which was the first power-driven machine to be invented in the wood-based industrial sector during the nineteenth century. This development was brought about by the increase in demand for sawnwood.

According to Dare (1979), it was stated that Akure was one of the towns to enjoy the benefit of the power-driven sawmill in 1907. This was as a result of the pilot scheme undertaken by the government at that time. Others were located at Ibadan and Zaria. Since then, the use of axes and pit sawing was abandoned for power saw as the main equipment for felling and extraction of timber.

Moreover, at the end of the second world war, many countries like the United Kingdom and South Africa were involved in the reconstruction of their towns and cities which had been devastated by the war. At that time, there was high demand for lumber for reconstruction in the forest zones of Nigeria This led to increased interest of Nigerians in production and marketing of sawnwood to meet both local and external demands for wood and wood products.

Ever since then, the number of sawmill industries have been on the increase and majority of them were owned by the private entrepreneurs. Government only participated in the conservation and management of forest. For instance, in 1939, there

were sixteen (16) sawmills in Nigeria, this increased to 21 in 1946 (Ifebueme, 1993). The industry recorded a significant increase to 35 in 1952 and eighty (80) in 1962. Between 1964 and 1973 the number of sawmill increased from eighty (80) to 600 (F.A.O.,1979) and was further increased to about 1200 in 1985 (Badejo, 1985). Table 3 showed the estimates of sawmills in Nigeria between 1970 and 1980..

Furthermore, as a result of the high demand for sawnwood the sawmilling industry became highly lucrative and attractive. Therefore, many people go into it even without previous and adequate training preparation (Adenuga, 1977). About seventy percent (70%) of all sawnwood in Nigeria is produced by the small-scale sawmills (Huuhtanen, 1975). This explains why the industry is characterized by a proliferation of small-scale portable sawmills.

Over the years, a lot of forest exploitation has been carried out to meet the increasing demand of the teeming population. Coupled with this is the rapid increase in the number of sawmills for the production of wood for construction activities which had led to wood shortage (Wellwood, 1966)

Table 4 presents a trend in wood demand and supply pattern in the sawmill industry between 1974 and 2000. It showed an equilibrium between demand and supply in 1974 while year 2000 recorded a deficit of 1.83 million cubic metres in wood supply.

Table 3: Estimates of sawmills in Nigeria1970-1980

Year	Total Number of sawmills
1970	132
1975	348
1976	435
1978	600
1980	1,000

Source: Adenuga (1981)

Table 4:Anticipated Demand and Supply of Timber

Year	Demand (million m^3)	Supply (million m^3)	Deficit (million m^3)
1974	1.09	1.09	-
1980	2.54	2.49	0.26
1990	5.53	4.81	0.62
2000	11.00	9.17	1.83

Source; Obeche Volume 12 page 2 (1976)

The wood supply shortage to our sawmill industry had been anticipated by Okigbo (1964) and Adeyoju (1975). The deficit in sawnwood supply was expected to shoot-up from 1.8million cubic metres in 1995 to an estimated figure of10.2 million cubic metres by the year 2010 (F.A.O).

2.2 LOCATION AND DISTRIBUTION OF SAWMILLS IN NIGERIA

In a survey conducted by Akindele and Fuwape (1998), it was reported that the increase in the scarcity of raw materials due to the upsurge in deforestation coupled with the attendant economic hardship over the past years had forced down the number of sawmills in the country. In the same study conducted in 28 states of the federation, it was observed that most of the sawmills are located in the south western part of the country with Ondo State at the top of the chart as shown in Table 5

Moreover, the concentration of sawmills in the western part was influenced by the climatic distribution of vegetation which is responsible for the high concentration of trees in this area. The forest zones falls in the western part of the country, thus the concentration of sawmills in this zone.

Figure 1 showed the distribution of sawmill according to the vegetational zones in Nigeria as indicated by the report of the study.

Generally, sawmills are found to be located in towns and cities with very few of them in the rural areas where there is adequate raw materials. However, the concentration of sawmill in the urban centres were due to the presence of basic amenities like good road and electricity supply.

In a study of sawmills in Akoko division (Akoko North and Akoko South) Local Government Areas of Ondo State, it was discovered that the sawmills were market-oriented as raw materials were obtained far from the mill site (Falusi, 1979).

In a related survey carried out by Nwokeabia (1981). It was observed that some of the sawmills in Ekiti State, were poorly located. In his own assertion, Fasuru (1979) stated that some of the sawmills were located among residential building, thereby limiting the scope for future expansion. In addition, he said some of the sawmills were located too close to the road, thus creating traffic hazards.

In their own contribution, Adenuga and Omoluabi (1980) also made references to adminiatration in sawmills. They opined that the general trend in the sawmill business was that of poor administration arising from the lack of training scheme for workers.

Table 5: Distribution of Sawmills among some States in Nigeria

State	Numbers of sawmill
Abia	3
Adamawa	0
Akwa-Ibom	5
Anambra	0
Bayelsa	0
Benue	12
Cross Rivers	12
Delta	85
Ebonyi	0
Edo	123
Ekiti	98
Enugu	1
Imo	1
Kaduna	0
Kano	0
Kebbi	0
Kogi	58
Kwara	22
Lagos	178
Nasarawa	0
Niger	19
Ondo	262
Ogun	203
Osun	153
Oyo	103
Plateau	0
Rivers	13
Taraba	1
Total	1349

Source: Akindele Fuwape (1998)

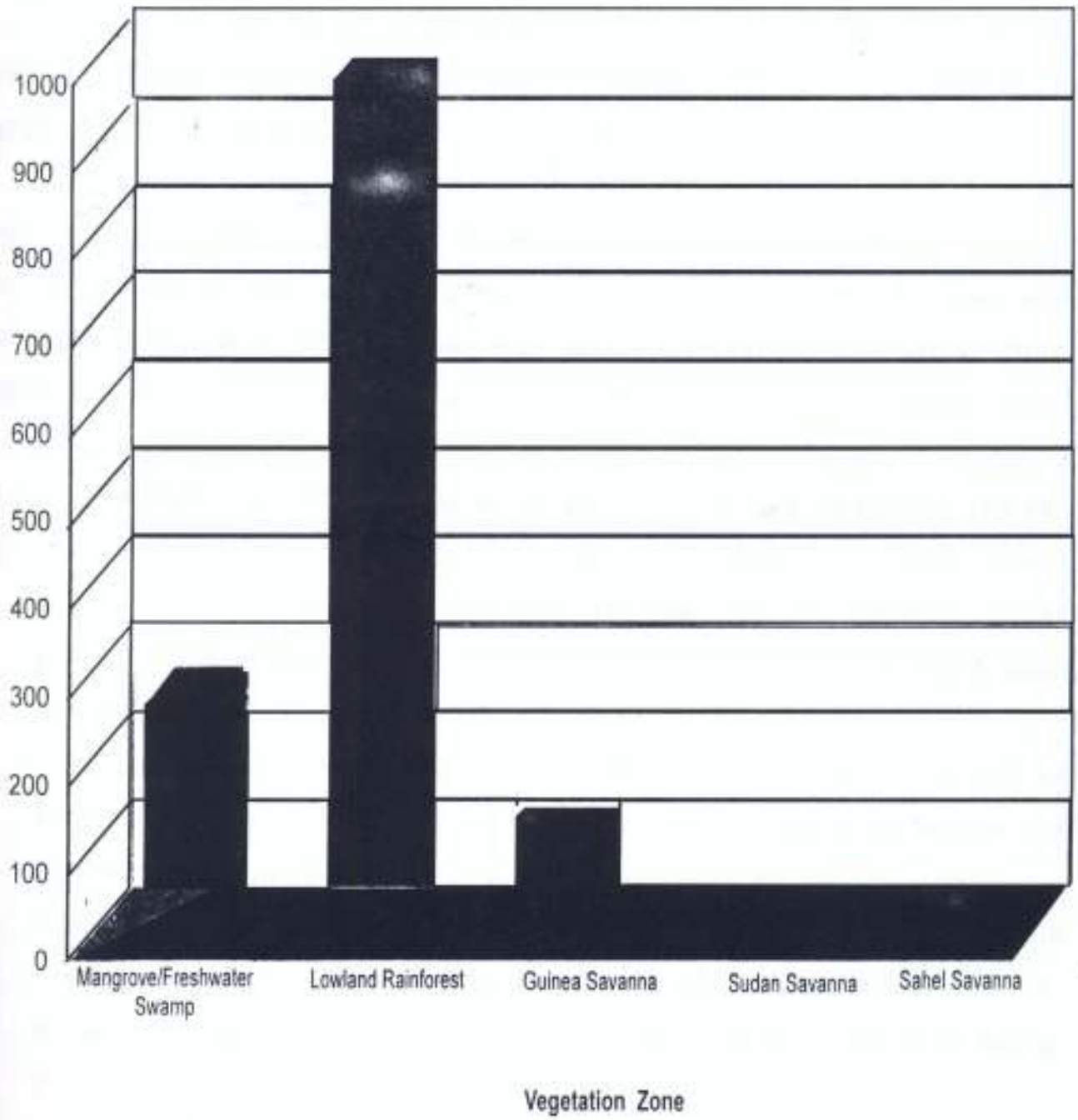

Fig.1: Distribution of Sawmills according to Vegetation Zones in N'geria.

2.3 CLASSIFICATION OF WOOD-BASED INDUSTRY IN NIGERIA

The classification of wood industries was based on the one made by the General Woods and Veneers Consultants limited (**GWVC**, 1994). Wood industries were categorized into two namely: Formal and Informal sector enterprises.

The formal sector enterprises are made up of sawmills, plywood, particle boards, furniture and paper industries. These are industries whose production can be statistically registered and were duely established in accordance with the law of the country.

The informal sector, he pointed out, are those of small wood-based industries whose activities in the primary processing segment, are not duely registered under the law. They do not produce company balance sheet or pay company tax. The numerous small-scale sawmills are the major industrial segment of the informal sector. Other enterprises in this category are those involved in the production of canoe, wood carvings and charcoal.

2.3.1 CLASSIFICATION OF THE SAWMILL INDUSTRY IN ONDO STATE.

A sawmill can be seen as wood processing equipment usually power-driven, used to saw log into various sizes (Okigbo, 1964). Furthermore, Afolabi (1978) also defined sawmilling operations as the mechanization of cutting wood into sizes useful to man.

Sawmilling is a simple technology that requires minimum number of equipment to achieve its goal. The capacity of each mill depend on the size and level of technology. The principal equipment is usually the frame saw while the bandsaw and the circular saw serve as supporting equipment. However, in Nigeria where most of our sawmills operate on small scale, the band saw serves as their main equipment while the circular saw are used for trimming of lumber (Sanwo, 1982)

According to Olawasusi (1981), the sawmills in Ondo State were classified into three (3) major categories based on their scale of operation are as follows: Small, Medium and Large scale. The parameters used for these classifications were based on output and labour utilization. He further stated that

output is a more convinient method for classifying sawmills in the sense that it is quantifiable. This classification was made with reference to N.I.S.E.R.(1971) classification.

On the basis of output, sawmills which have a daily output ranging between 7 and 14 cubic metres of sawnwood is classified as small scale mill. A sawmill turning out between 14and 28 cubic metres of sawnwood per day is categorized as medium scale mill, sawmill operating above 28 cubic metres of sawnwood per day is said to be a large scale mills.

Moreover, sawmills are also classified on the basis of the capacity of the bandsaw machine used in the mill. Based on this classification, Ondo State Forestry Division (1987) stated that out of 242 licenced sawmills in the state as at that time, only four (4) were classified as large scale, six (6) as medium scale while 232 were small scale sawmills.

In a related survey conducted by Sanwo (1982) on sawmill classification, he described a typical small size mill as one which consist of a horizontal bandmill as primary wood processing machine while a circular saw of 15cm to 18cm in size serves as secondary conversion of slabs and offcuts.

The second classification of sawmill was based on the Labour Utilization in the mill. In his own opinion, Oluwasusi (1981) stated that Large mill usually have fewer number of labour relative to mill equipment. The small size sawmills are known to have higher number of labour relative to mill equipment while the medium scale was said to have labour force between that of small and large scales.

2.4 MACHINES AND EQUIPMENT USED IN SAWMILLING OPERATIONS.

There are several machines used in the sawmilling industry. The capacity of each depends on the sizes and level of technology. The sizes vary from portable power saws to large machines which can handle large volume of round log (Wahl, 1978).

In his reaction to the sawmilling operations in Nigeria, Segun (1969) said most of the wood processing taking place in the mill are done with the aid of primary conversion machines such as the French made **CD** horizontal bandsaw, and the circular saw used as secondary conversion equipment.

The mobile horizontal bandmill machines such as the **CD**, Nobis, Forestor and Jevo are in use in the small scale mills. There are other sophisticated equipment in the medium and large scale sawmills which make wood conversion easier. Such equipment include cranes, conveyors and pulleys for moving logs toward the saw machines. Others are CDIO horizontal band mill, Robinson vertical bandmill and vertical frame saws which are capable of handling large volume of wood (Adewale, 1988).

On the repairs and maintenance of the saw blades, Adenuga (1980) affirmed that such activities are usually carried out in the saw doctor's shop. This shop he said, is usually an extension of the sawmilling activities. The equipment used in this section include a motorized rolling machines and levelling block with an automatic sharpening devices.

2.4.1 MAINTENANCE OF SAWMILLING EQUIPMENT

In a lecture delivered by Seppo [1980] on sawmilling in developing countries, he opined that most of the sawmill machines used in developing countries such as Nigeria are, in most cases, worn-out. He pointed out that this is largely due to inadequate maintenance, probably, as a result of prohibitive cost of spare parts most of which have to be imported.

In most cases, preventive measures/maintenance is often neglected and worn-out parts are repaired or changed too late. In addition, there are situations where a machine is kept runing without service for a long-term. As a result of this, considerable damage is done to the machine leading to long break-down period.

The common maintenance practices include replacement of bearings, greasing wheel grinding and alignment of wheel (Adenuga and Omoluabi, 1980).

2.5 LABOUR AND LOG INPUT CAPACITY OF SAWMILL INDUSTRIES.

Labour and entrepreneurship represent the human resource aspect of the factor input and are the most important resource employed in production (Ojo, 1999). Moreover, Olayide and Heady (1982) pointed out that this human resource constitute the decision making powers in any production scheme.

According to the findings of Alvier (1983), the type of labour employed in sawmilling operation depend on the scale of operation and location of the mill. He gave an example of a mill operating on a small scale having between 10 and 15 workers, while medium and large sawmills have higher number of workers.

In some mills, the category of workers employed on permanent basis are the mill managers, saw doctors and nightguards while other workers are regarded as casual workers.

Table 6 showed the distribution of number of sawmill and log input capacity by size. The table shows that the small scale mills employed larger number of workers (about 81%) than the medium and the large economies. Also the total small scale mill's wood input capacity was 64% while that of large scale one was 14%.

Table 6 Distribution of number of sawmills and log input capacity of sawmill industry by size.

Sawmill size	No of workers	Mills number	%	Log input capacity ooom^3 %
Small [Below 10m^3 per shift]	9,615	874	81	7,127 64
Medium[over 10m^3 to 30m^3/ahift]	2,190	146	14	2,383 22
Large [over 30m^3 per shift]	4,580	56	5	1,582 14
Total	16,385	1,076	100	11,092 100

Source: Alivar, G. (1983)

2.6 MILL EFFICIENCY AND PRODUCTIVITY

One of the parameters used to measure efficiency and productivity in the mill is the Lumber Recovery Ratio (**L.R.R**). It is defined by Badejo (1985) as the ratio of nominal board feet of Lumber recovered per cubic foot of log used in the mill.

Mill efficiency he said, also helps to determine the volume of wood waste or residue generated by the mill at a given time.

McBride (1963), in his study on the lumber recovery ratio, pointed out some of the factors that affect this ratio include mill type, log size, lumber thickness, scale of operation and management policy.

In a related study conducted by Alviar (1983) on product recovery rate for 17 **CD** horizontal bandmill headrig machine it was discovered that about forty-seven (47%) of the product (sawn wood) was recovered while fifty-three percent (53%) accounted for residue such as slabs, sawdust and barks.

Another reason he adduced for low productivity was the traditional practice of cutting planks into 12 feet by 12 inches in length and breadth respectively. This practice renders big volume of slabs to be discarded as waste. In addition, inefficiency and low productivity experienced in some of the sawmills were largely due to lack of education. Education is regarded as the fourth compulsion of life after food, clothing and shelter. It produces a labour force that is more skilled, more adapted to the need of a changing economy and more likely to develop the imaginative ideas and techniques which are critical to the process of economic development (Agrawal and Lal, 1977)

Also Strumulin (1964) reported that a year of primary education in Russia increases the workers productivity on the average by as much as 30%, the higher the education the higher the productivity.

However, in most of the sawmills, the management staff lacked the required education, technical skills and knowledge of administration (Dare,1979).

Most of the sawmill managers lacked secondary education. Such managers were appointed as a result of their long years of experience on the job.

2.6.1 PROFITABILITY OF SAWMILLING OPERATION

In his own contribution, Adenuga [1984] opined that the profitability of the mill is a function of the level of production efficiency. He gave an example of a typical medium operating a single shift at between 30% and 65% recovery level. For instance at a recovery level 30% and 35%, output value was ₦810,000 and ₦877,500 respectively, the sawmill is said to be operating at a loss at this level. However, at 40% recovery level, output value became ₦1,080,000 and a gross profit of ₦63,135 was obtained and this represented a gross profit of 16.% on capital invested per annum as shown in Table 7.

Also, the same table showed that at 50% recovery level, the break-even point was 1330m^3 which represented 17.% on sales. The table showed that the profitability of a sawmill increases with recovery rate, while the break-even point reduces.

Table 7: Trend of profitability in a medium scale sawmill operating a single shift.

Recovery level (%)	Output value (N)	Gross profit (N)	Gross profit on Capital (%)	Profit on sales (%)	Break-even point m^3	Break-even point on sales (%)	Asset Turn over
30	810,000	206,865	-54.9	-25.5	-2396	-53.2	2.1
35	877,500	-139,365	-37.0	-15	-5190	-106.2	2.3
40	1,080,000	63,135	16.8	5.8	3194	53.4	2.9
50	1,350,000	333,135	88.4	24.7	1330	17.7	3.6
60	1620,000	603,135	160.1	37.2	958	10.0	4.3
65	1,755,000	738,135	195.9	42.1	865	8.9	4.7

Source: Adenuga (1984).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 STUDY AREA

The study area for the project consisted of six Local Government Areas in Ondo State. The Local Government Areas include Akure South, Akoko North East, Ose, Idanre, Odigbo and Ondo West.

These areas were chosen in view of the abundance of sawmill industries in the area. In addition, these areas are blessed with large hectarages of forest reserves, well stocked with various tree species.

Also the area is famous for its diverse nature in terms of cultivation of crops ranging from tree crops to tuber crops, grain, vegetable and fruit crops. Other important crop grown are cocoa, oilpalm, kolanut, coconut, yam, cassava, cocoyam, groundnut, okro and maize. There are also some livestock farmers and hunters in these Local Government Areas.

3.2 DATA SOURCE

The data used in this study were both primary and secondary in nature. The primary data were collected through the use of a questionnaire. Secondary data were collected from different publications of the Ministry of Agriculture and Rural Development, Ondo State.

Table 8 shows how the sets of questionnaire were distributed among the study areas.

Only eight-six (86) out of one hundred (100) copies of the questionnaire administered were completed and returned.

The rest fourteen (14) could not be located due to misplacement and uncooperative attitude of few respondents.

Table 8: Distribution of Questionnaire among Respondents

Local Government Areas	Number of questionnaire
Akure South	22
Akoko North East	13
Ose	17
Idanre	17
Odigbo	13
Ondo West	18
Total	100

3.3 SAMPLING PROCEDURE

The sampling method employed is multi-stage sampling, involving purposive sampling and random sampling method. The sample frame consists of all registered sawmills in Ondo State. Their list was obtained from the Ministry of Natural Resources Department of Forestry and Wildlife Services, Ondo State.

Local Government Areas were purposively sampled to include those Local Government Areas with rainforest belt in the state, while the respondents were selected using simple random sampling technique. In this selection, every sawmill in the selected Local Government Areas had the probability of being selected.

3.4 METHOD OF ANALYSIS

Among the suitable statistical methods for the analysis of the data are:-

i Descriptive statistics like frequency distribution, mean, standard deviation and percentages were used to analyses the socio-economic characteristics such as age, house-hold size, educational status, experience in sawmilling, and labour utilization of the saw millers.

ii The budgetary analysis (Gross margin and Net revenue) was used to examine the profitability of the sawmilling industries in the study area.

Gross margin is the total revenue less total variable cost, that is,

Gross Margin =Total Revenue-total variable cost

The Net Revenue is the Total Revenue less Total Cost, that is

Net Revenue =Total Revenue - Total cost

iii The production function analysis using the ordinary least square method was used to estimate the production function parameters.

3.5 MODEL SPECIFICATION:-

The production technology of the three types of scales of sawmill operations is specified implicity by

$$Y = f(x_1, x_2, x_3, x_4, x_5, U)$$

Where,

Y= Output of wood in cubic metre (m^3)

X_1= Log processed (m^3)

X_2= Labour (Mandays)

X_3= Educational level (years)

X_4= Experience in year (yrs)

X_5= Operating expenses (N)

U= Error term

The data were fitted to three different types of Functional forms namely:- Linear, Semi log and Cobb-Douglas forms. The estimated equations were appraised on the basis of magnitude of coefficient of determination R^2 or adjusted R^2 (R^2),sign of estimated coefficient, size of stardard error of overall model, significance of estimated coefficient and the ease of interpretation.

log processed (x_1):- log processed (x_1) is the quantity of wood brought to the sawmill for processing. The a priori expectation of log processed (x_1) is that it should have positive coefficient, that is any increase in the quantity of log processed should lead to increase in the output of wood.

Labour (x_2):- Labour is the totality of human efforts used in the production process. It is measured in mandays, that is the work done by an average man in eight hours. Apriorily, increase in mandays is expected to lead to increase in output, thus it is expected to have a positive sign.

Educational level (x_3):- Education level was measured as the number of years spent in school. Education is expected to improve the sawmiller`s management skills and thus has positive bearing on his output and even productivity. Therefore the a priori expectation is a positive sign from this variable.

Experience (x_4):- This is the length of period the respondents have been involved in the operation of sawmilling. It is expected that the higher the experience the more efficient and productive the activities of the respondents. Thus the a priori expectation of x_1 is positive sign on its coefficient.

Operating expenses (x_5): Operating expenses are cost incurred during the production cycle of one year e.g. cost generally is expected to be minimized to maximize profit, therefore the a priori expectation is that the sign on this variable should be negative for output to be maximized.

Operating expenses include, cost incurred on electricity, sawblade, fuel and lubrication.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 SOCIO-ECONOMIC CHARACTERISTICS OF SAWMILL OPERATORS IN ONDO STATE

The socio-economic characteristics of the sawmillers which influence their level of production are enumerated below.

4.1.1 Age Distribution

The age distribution of sawmill operators under the three scale enterprises is as presented in Table 9. The sawmillers within the age bracket of 21-50 years represent about 65.22% in the small scale technology, it was 36.67% in the medium scale and 40% in the large scale technology. The result showed that about 60% of sawmillers operating on medium and large scale were relatively old, that is, about 50years; while relatively young or middle age sawmillers could only afford to operate within the small scale due to the large capital outlay demanded by the trade.

4.1.2 Household Size

The household size distribution of the sawmill operators under the small, medium and large scale enterprises is presented in Table 10.

Results of field data collected showed that 67.3% of the respondents had household size of between 4 and 7 members, with 32.61% of them having larger household size between 8 and 15 members per household. For the medium scale sawmillers, about 90% had household size that was less than 8 members, while about 70% of respondents in the large-scale enterprises had household size of less than 8 members. It was also observed that about 32.61% small-scale sawmillers, 10% medium scale sawmillers and 30% large sawmillers had very large household sizes with members of between 8 to 15. this implies that majority of the sawmill operators keep small family size as their services is not required in the production process.

Table 9: Age Distribution of Sawmill Operators

Age (yrs)	Small Scale Freq.	%	Medium Scale Freq.	%	Large Scale Freq.	%	Total Freq.	%
21-30	2	4.34	0	0	0	0	2	2.33
31-40	10	21.74	4	13.33	1	10	15	17.44
41-50	18	39.13	7	23.33	3	30	28	32.56
51-60	11	23.91	10	33.33	4	40	25	29.07
61-70	5	10.87	7	23.33	1	10	12	15.12
71& above	5	0	2	6.67	1	10	3	3.49
Total	46	100	30	100	10	100	86	100

Source: data analysis, 2000.

***Table 10*: Household size distribution of respondent sawmillers**

Household size	Small Scale		Medium Scale		Large Scale		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Under 4	5	10.87	0	0	0	0	6	5.81
4-7	26	56.52	27	90	7	70	60	69.77
8-11	13	28.26	3	10	3	30	19	22.09
12-15	2		0	0	0	0	2	2.33
Total	46	100	30	100	10	100	86	100

Source: data analysis, 2000

1.3 Educational Status

The educational status of sawmill operators is presented in Table 11. About 89.13% of respondents operating on small scale had secondary or above secondary school education while about 93.33% and 100% of sawmillers in medium and large scale had secondary or above secondary school education. The result revealed that education may be important in sawmill operations.

.4 Experience in Sawmill operation

The experience in years of sawmill operation is presented in Table 12. The results of the data analysis showed that about 86.96% of sawmillers operating on small scale had experiences of over five years. Sawmillers in the medium and large scale with above five years experience were 96.67% and 100% of respondents respectively. This implies that experience in sawmilling operations may be necessary condition before a sawmill operator can move from small scale to medium or large scale.

Table11: Education Status of Sawmill Operators

Education	Small Scale		Medium Scale		Large Scale		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Primary	5	10.87	2	6.67	0	0	7	8.14
Secondary	35	76.09	22	73.33	7	70	64	74.42
Tertiary	6	13.04	6	20	3	30	15	17.44
Total	46	100	30	100	10	100	86	100

Source: data analysis, 2000

Table 12: Experience in Years

Years of operation	Small Scale		Medium Scale		Large Scale		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Under 5	6	13.04	1	3.33	0	0	7	8.14
5-10	24	52.17	24	80.00	5	50	53	61.63
11-15	13	28.26	5	16.67	4	40	22	25.55
16-20	3	6.52	0	0	1	10	4	4.65
Total	46	100	30	100	10	100	86	100

Source: data analysis, 2000.

1.4 Labour Utilization

The type and number of labour employed by the sawmill operators for their sawmilling operations are presented in Tables 13 (a) and 13 (b)

Table 13 (a) shows that the three scale operations used mostly hired labour. Small scale sawmillers used about 89.13% hired labour for their operations. It was about 96.67% for medium scale sawmillers and 100% for large scale sawmills. About 10.87% of the small scale sawmillers used a combination of hired and family labour for their operation. This implies that sawmill operation is mostly hired labour dependent.

Table 13 (b) shows the number of workers employed under each scale. About 45.65% of sawmillers in the small scale enterprises employed less than 10 workers per sawmill while only 10% of respondents in the medium scale enterprises employed less than 10 workers and large scale enterprises employed large number of workers.

This implies that sawmilling operation is labour intensive and as scale of operation increases due to the acquisition of many sophisticated machines more labourers are required to operate them.

Table 13(a): Types of Labour Used

Labour	Small Scale		Medium Scale		Large Scale		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Hired	41	89.13	29	96.67	10	100	80	93.02
Hired & Family	5	10.87	1	3.33	0	0	6	6.98
Total	46	100	30	100	10	100	86	100

Source: data analysis, 2000.

Table 13 (b): Number of Workers Employed

No of Workers	Small Scale		Medium Scale		Large Scale		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
1-10	21	45.65	3	10	-	-	24	27.91
11-20	23	50.00	24	80	1	10	48	55.81
21-30	2	4.35	3	10	7	70	12	13.95
31-40	-	-	-	-	2	20	2	2.33
TOTAL	46	100	30	100	10	100	86	100

Source: data analysis, 2000.

6 Method of Acquiring wood for processing

The major method of acquiring wood for processing is through acquisition of forest area from the government. Other methods include obtaining logs from forest allotees, middlemen, field purchase and cutting from free areas.

Tables 14 (a) and 14 (b) present the summary of the methods of acquiring wood for processing.

Majority (68.61%) of sawmillers have small forest size. About 91 of small scale sawmillers had forest size of less than 10 hectares each. The large scale sawmillers require large forest area to ensure adequate supply of log for processing. About 40% of large scale sawmillers had forest area of over 20 hectares each as shown in Table 14 (a).

Apart from acquisition of log from forest allocation from government, sawmillers also purchase logs from forest allotees who have no sawmills of their own (middlemen) as well as purchasing of logs from the field. Among the small scale sawmillers, field purchase is the most important source of wood while logs from middlemen is the most important source of wood to the large scale sawmillers as shown in Table 14 (b)

Table 14 (a): Size of Forest Area

Forest Size (Ha)	Small Scale		Medium Scale		Large Scale		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Less than 10	42	91.30	17	56.67	-	-	59	68.61
10-16.99	4	8.70	12	40.00	6	60	22	25.58
20 and above	-	-	1	3.33	4	40	5	5.81
Total	46	100	30	100	10	100	86	100

Source: data analysis, 2000.

Table 14(b): Alternative means of obtaining Logs

Alternatives	Small Scale		Medium Scale		Large Scale		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Forest Allotees	3	6.52	-	-	1	10	4	4.65
Middle Men	15	32.61	10	33.33	4	40	29	33.72
Field Purchase	19	41.30	10	33.33	2	20	31	36.05
Free Area	9	19.57	10	33.33	3	30	22	25.58
Total	46	100	30	100	10	100	86	100

Source: data analysis, 2000.

4.1.7 Marketing Channel for Sawmill Products (Planks)

The major product of sawmill operation is planks of different specifications (sizes). These planks (lumber) are disposed of in a number of ways which include wholesaling, retailing and sales to the final consumers. Table 15 presents the summary of channels of sales of sawmill products. About 60.87% of small scale sawmillers, 53.33% medium scale sawmillers and 50% large scale sawmillers sold their planks to retailers. The study showed that sawmiller in the study area sold their products mostly to retailers and wholesales.

4.2 PROFITABILITY ANALYSIS

This section examines the cost, revenue, Gross margin and net Revenue analyses of sawmill operations under the three scale economies.

4.2.1 Analysis of Costs and Returns

Table 16 shows the analysis of cost for sawmill operations under the small, medium and large scale enterprises. The mean labour cost per cubic metre of processed wood was ₦65.56 for small scale sawmills, ₦28.93 for medium scale and ₦20.30 for large scale sawmills. This implies labour use efficiency increases with scale of operation. The mean operating expenses per cubic metre of processed wood was highest for small sawmills and least for Large sawmills. It was ₦75.83 for small sawmills, ₦35.09 for medium sawmills and ₦14.83 for large sawmills. It implies that as the scale of operation increases, there is economy of size and cost of production reduced with size that is, the higher the size of production, the lower the cost of production.

4.1.7 Marketing Channel for Sawmill Products (Planks)

The major product of sawmill operation is planks of different specifications (sizes). These planks (lumber) are disposed of in a number of ways which include wholesaling, retailing and sales to the final consumers. Table 15 presents the summary of channels of sales of sawmill products. About 60.87% of small scale sawmillers, 53.33% medium scale sawmillers and 50% large scale sawmillers sold their planks to retailers. The study showed that sawmiller in the study area sold their products mostly to retailers and wholesales.

2 PROFITABILITY ANALYSIS

This section examines the cost, revenue, Gross margin and net Revenue analyses of sawmill operations under the three scale economies.

2.1 Analysis of Costs and Returns

Table 16 shows the analysis of cost for sawmill operations under the small, medium and large scale enterprises. The mean labour cost per cubic metre of processed wood was ₦65.56 for small scale sawmills, ₦28.93 for medium scale and ₦20.30 for large scale sawmills. This implies labour use efficiency increases with scale of operation. The mean operating expenses per cubic metre of processed wood was highest for small sawmills and least for Large sawmills. It was ₦75.83 for small sawmills, ₦35.09 for medium sawmills and ₦14.83 for large sawmills. It implies that as the scale of operation increases, there is economy of size and cost of production reduced with size that is, the higher the size of production, the lower the cost of production.

Table 15: Marketing Channels for Sawmill Product (Planks)

Channel	Small Scale		Medium Scale		Large Scale		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
Wholesalers	13	28.26	11	36.67	4	40	28	32.56
Retailers	27	60.87	16	53.33	6	60	50	58 .14
Consumers	5	10.87	3	10.00	-	-	8	9.30
Total	46	100	30	100	10	100	86	100

Source: data analysis, 2000

Table 16: Comparative Analysis of Cost

Variables	Small Scale ₦	Medium Scale ₦	Large scale ₦
Output (m^3)	377.15	8889.33	30330
Labour Cost	247352.20	257180.33	615614
Operating Expenses	286126.22	311925.77	449864.40
Total Variable Cost (TVC)	533478.42	569106.10	106570.40
Fixed Cost (FC)	167856.65	294365.31	506080.63
Total Cost (TC)	701335.07	863471.41	1571559.03
Labour Cost/m^3	65.56	28.93	20.30
Operating Expenses /m^3	75.83	35.09	14.83
TVC/m^3	141.39	64.02	35.13
Fixed Cost /m^3	44.49	33.11	16.69
Total Cost /m^3	185.88	97.13	51.82

Source: data analysis, 2000

4.2.2 Analysis of Gross Margin and Net revenue of Sawmilling Operations

Table 17 gives the summary of the analysis of Gross Margin and Net Revenue of sawmilling operations under the three scale enterprises. The mean Revenue per cubicmetre of processed wood was ₦366.13 for small sawmills, ₦330.60 and ₦295.98 for medium and large sawmills respectively. The gross margin per cubic metre of processed wood was ₦224.74 for small sawmills, ₦266.60 for medium and ₦260.85 for large sawmills. The Net Revenue per cubic metre of processed wood was ₦180.25 for small sawmills, ₦233.50 for medium and ₦244.16 for large sawmills. It implies that large and medium sawmills are more profitable than small sawmills. The results further show that even though medium and large sawmills mean revenue per cubic metre of processed wood is lower than that of small sawmills, the former have larger Gross Margin and Net revenue per cubic metre of processed wood because they enjoy the benefit of economies of scale such as low cost of production per unit of output and large production of output.

Table 17 **Gross Margin and Net Revenue Analysis**

Variables	Small Scale	Medium Scale	Large Scale
Output (m^3)	3773.15	889.33	30330
Total Variable Cost (TVC)	533,478.42	569,106.10	1,065,478.40
Total Cost (TC)	701,335.07	863,471.41	1,571,559.03
Revenue	1,381,451.74	2,939,006.67	8,977,000
Gross Margin (GM)	847,973.32	2,369,900.31	7,911,521.60
Net Revenue (NR)	680,116.67	2,075,535.26	7,405,440.97
TVC/m^3	141.39	64.02	35.13
TC /m^3	185.88	97.13	51.82
Revenue /m^3	366.13	330.62	295.98
GM/m^3	224.74	266.60	260.85
NR /m^3	180.25	233.50	244.16

ource: data analysis, 2000.

PRODUCTION FUNCTION ANALYSIS

4.1 Summary statistics of variables for the estimation of production function parameters

The summary statistics of the variable for the estimation of the parameters of the production function are presented in Table18 to 20

Output (Processed Log)

The mean output of processed wood in cubic metre was 3773.15m^3 for small sawmills with standard deviation of 799.22m^3. it was 8889.33m^3 with standard deviation of 3065.91m^3 for medium sawmills and 30330m^3 with standard deviation of 7664.35m^3 for large sawmills. The result shows that large sawmills produce larger processed wood per sawmill.

Inputs Utilization

The inputs used, namely: log for processing, labour, operating expenses and fixed cost increase with scale of production.

Experience

The results show that sawmill operators under the large scale had a mean year of experience of 11.5 years as against 8.91and 8.63 years for small scale and medium scale sawmill operators respectively.

This indicates that large scale sawmills require more experience than small and medium scale ones. In other words, experience is one of the main factors that could lead to success in large scale sawmill management.

Table 18: **Summary Statistics of Variables for the estimation of production Function Parameters and profitability for small scale sawmills.**

Variables	Mean	Standard Deviation
Output (m^3)	3773.15	799.22
Revenue (₦)	1381451.74	211303.32
Log for Processing (m^3)	5389.26	1291.70
Education	12.5	2.76
Labour (Mandays)	1751.76	644.26
Experience (Years)	8.91	3.98
Labour Cost (₦)	247352.20	71944.06
Operating Expenses (₦)	286152.20	81557.12
No of Sawmillers	46	

Source: Data Analysis, 2000

Table 19: **Summary statistics of variables for the estimation of production Function Parameters and profitability for medium scale sawmills.**

Variables	Mean	Standard Deviation
Output (m^3)	8889.33	3065.91
Revenue (₦)	2939006.67	976077.68
Log for processing (m^3)	12775.2	4072.03
Education	13	2.4
Labour (Mandays)	1815	267.38
Experience (Years)	8.63	2.125
Labour Cost (₦)	257180.33	45998.5
Operating expenses (₦)	311925.77	84264.41
No of Sawmillers	30	

Source: Data analysis, 2000.

Table 20: **Summary of variables for the estimation of production function Parameters and profitability for Large Scale Sawmillers.**

Variables	Mean	Standard Deviation
Output (m^3)	30330	7664.35
Revenue (₦)	8977000	268985.77
Log for processing (m^3)	37750	9755.14
Education	13.5	1.5
Labour (Mandays)	3291.1	649.29
Experience (years)	11.5	4.45
Labour Cost (N)	615614	140774.96
Operating expenses (N)	449864.4	65166.06
No of Sawmillers	10	

Source: Data Analysis 2000.

4.3.2 Estimated Production Function

The estimated production functions for the three sawmills economies are presented in Table 21 to 23. Table 21 presents the three estimated functional forms of the production function of small scale sawmill.

The power function was chosen as the lead equation on the basis of largest adjusted R^2, smallest standard error of overall model and the ease of interpretation.

The analysis of the lead equation shows that the postulated explanatory variables explained about 81.1% in the variations in the dependent variable. The coefficient of log for processing carried positive sign, it was less than unity and significant at 5% level of significance, indicating a decreasing positive return to the factor. It means there was efficient allocation and utilization of the input. Since it use is in stage II of the production region. It agreed with a priori expectation.

The coefficient of labour showed an increasing returns to factor, indicating the use of this factor was still in the irrational zone of production (stage 1) and thus its use must be increased. It also agreed with apriori expectation.

The coefficients of education, operating expenses and years of experience in sawmilling operation carried negative signs. This indicates that the allocation and utilization of these factors were in stage III of the production function and this is against a priori expectation, especially for education and years of experience

Table 21: **Ordinary Least Square [OLS] Estimates of Parameters of the Production Function of Small Scale sawmill in Ondo State.**

Variables	Parameters	Linear Function	Semi log Function	Cobb Douglas
Constant	B0	1116.2	-222	0.796
		(2.95)	(-9.50)	(1.26)
Log for processing	B1	*0.529	*2524.9	*0.749
		(10.18)	(10.24)	(11.20)
Labour	B2	0.115	369.10	7.986
		(1.06)	(1.91)	(1.53)
Education	B3	-20.346	-85.44	-0.029
		(-0.96)	(-0.42)	(-0.524)
Experience	B4	-26.51	-200.90	-0.054
		(-1.75)	(-1.67)	(-1.65)
Operating Expenses	B5	-0.00015	170.33	-0.45
		(0.83)	(1.17)	(1.14)
R^2	R^2	0.793	0.814	0.832
R^2	R^2	0.768	0.791	0.811
Sx	Sx	390.24	370.02	0.100
F	F	30.702	35.05	39.57

Figures in parentheses are t-ratios

*Estimate is significant at 5% level of significance.

Source; Data analysis,2000.

Table 22 presents the three estimated functional forms of the production function of medium scale sawmills. The power function was chosen as the lead equation on the basis of largest adjusted R of 0.403, least standard error and two significant explanatory variables in the model.

The coefficient of log for processing (X_1), labour (X_2), operating expenses (x_5) and experience (X_4) carried positive signs and showed decreasing returns to the factors indicating these factors were efficiently allocated and utilized.

The coefficient of education was negative and highly significant at5% level of significance. For the medium scale sawmills, the variables of log for processing and education were highly significant at 5% level of significance.

Table 23 represents the three estimated functional forms of the production function of large-scale sawmill.

The power function was chosen as the lead equation on the basis of least standard error of the overall model and ease of interpretation. The analysis of the lead equation shows that the explanatory variables explained about 91.3% of the variations in the dependent variable.

The coefficients of log for processing (X_1), labour (X_2), and operating expenses (X_5) carried positive signs and each was a decreasing positive function with respect to the factor. This implies each of the factors are efficiently allocated and used? and was in stage II of the production function .

The coefficients of education and experience carried negative signs. This is against a priori expectation and it may be because the operators of the sawmills lacked function education and experience in the management of sawmills.

Table 22; **Ordinary least Square (OLS) Estimates of Parameters of the Production Function of Medium Scale Sawmill in Ondo State.**

Variables	Parameters	Linear Function	Semi log Function	Cobb Douglas
constant	Bo	-9060.5	-0.26×10^6	7.003
		(-0.50)	(-1.66)	(1.371)
Log for processing	B1	0.515	4956.2	*0.675
		(1.19)	(0.908)	(2.906)
Labour	B2	9.28	14347	0.754
		(1.49)	(1.327)	(1.647)
Education	B3	*-2033	*-21903	*-0.811
		(-2.91)	(-3.053)	(-2.671)
Experience	B4	1270.70	7347.1	0.317
		(1.58)	(1.179)	(1.211)
Operating Expenses	B5	0.020	7512.1	0.416
		(1.57)	(1.187)	(1.542)
R^2	R^2	0.417	0.417	0.506
$\bar{R}^2$	R^2	0.295	0.295	0.403
Sx	Sx	6365.7	6365.9	0.355
F	F	3.43	3.44	4.916

Figures in parenthesis are t- ratios

*Estimate is significant at5% level of Significance

Source: Data analysis 2000.

Table 22; **Ordinary least Square (OLS) Estimates of Parameters of the Production Function of Medium Scale Sawmill in Ondo State.**

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		(1.19)	(0.908)	(2.906)
Labour	B2	9.28	14347	0.754
		(1.49)	(1.327)	(1.647)
Education	B3	*-2033	*-21903	*-0.811
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Experience	B4	1270.70	7347.1	0.317
		(1.58)	(1.179)	(1.211)
Operating Expenses	B5	0.020	7512.1	0.416
		(1.57)	(1.187)	(1.542)
R^2	R^2	0.417	0.417	0.506
R^2	R^2	0.295	0.295	0.403
Sx	Sx	6365.7	6365.9	0.355
F	F	3.43	3.44	4.916

Figures in parenthesis are t- ratios

*Estimate is significant at5% level of Significance

Source: Data analysis 2000.

Tables 23: **Ordinary Least Square [OLS] Estimates of Parameters of the production function of Large scale sawmill in Ondo State**

Variables	Parameters	Linear Function	Semi Log Function	Cobb Douglas
Constant	BO	5749.6	$-0.237x10^{6}$	-0.076
		(0.554)	(-2.764)	(-0.021)
Log for processing	B1	*0.0006	*2772.4	*0.079
		(2.02)	(3.995)	(2.705)
Labour	B2	*0.507	*24529	*0.849
		(5.839)	(9.176)	(7.506)
Education	B3	-158.69	-5209.5	-0.138
		(-0.307)	(-0.908)	(-0.567)
Experience	B4	-139.75	-1370.8	-0.020
		(-0.697)	(0.743)	(0.256)
Operating expenses	B5	0.0011	-1184.1	0.045
		(0.159)	(-0.221)	(0.2)
R^2	R^2	0.964	0.9677	0.961
$\bar{R}^2$	$\bar{R}^2$	0.919	0.949	0.913
$S\bar{x}$	$S\bar{x}$	2165.9	1736.6	0.074
F	F	21.33	34.17	19.88

Figures in parenthesis are t- ratio

*Estimate is significant at 5% level of significance

source: Data analysis 2000.

4.3.3 Returns to Scale (RTS)

Table 24 presents the summary of returns to scale of the three types of sawmill under study. The study showed that the RTS for the small scale sawmills was8.607 and 1.351 for medium scale sawmills. This indicates that both small scale and medium sawmills were operating in the irrational zone (stage I) of the production and thus were inefficient and since the output from the sawmill operation is of economic relevance, the employment of these variables with positive elasticity of production namely, log for processing and labour, should be increased for small and medium scale sawmills.

The use of variables like experience and operating expenses should be increased for medium scale sawmills, while the use of variables whose elasticities carried negative sign should be reduced in the case of small and medium scale sawmills.

In the case of large scale sawmill, the returns to scale was 0.815. This indicates that large scale sawmills operated in the rational zone (stage II) of production function, and thus operated efficiently in the allocation and use of imputs and production of output.

Table 24: **Analysis of Returns to scale (RTS)**

Variables	Parameters	Small Scale	Medium Scale	Large Scale
Log for processing	B1	0.749	0.675	0.079
Labour	B2	7.968	0.754	0.849
Education	*B3*	-0.029	-0.811	-0.138
Experience	B4	-0.054	0.317	-0.02
Operating xpenses	B5	-0.045	0.416	0.045
RTS		8.607	1.351	0.815

Source: Data analysis 2000.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY

The study looked at the economic analysis of sawmill industries under three scale enterprises (small, medium and large) in six Local Government Areas of Ondo State. The study examined the socio-economic characteristics of sawmillers in the study area. It estimated and compared output, profitability and resource productivities in saw milling.

Data were collected from 86 sawmillers using purposive and simple random sampling methods from the six local Government Area through the use of structured questionnaire. The methods of analysis included Descriptive statistics, Budgetary analysis (Gross margin and Net Revenue) and the Production Function analysis.

The result of the socio-economic analysis showed that small scale sawmillers were younger than medium and large scale sawmillers. Also sawmillers in the medium and large scale had longer years of experience in the industry than small scale ones. The sawmillers had relatively moderate household size with about 69.77% of respondents having house hold size number of between 4and 7.

The sawmillers were relatively well educated with about 91.86% of the respondents having attended secondary school and above. The study observed that hired labour was mostly used in sawmill operations with large scale sawmills employing larger number of labour than others because of the complexity of its operations.

The study also observed that acquisition of forest area accounted for the major method of acquiring woods for processing while field purchases, middlemen and felling from free areas (forest area outside the government reserve) were the other alternative sources of wood for processing.

The profitability analysis showed that sawmillling operations were profitable in the study area.

The average gross margin per cubic metre of processed wood of the three types of sawmills ranged between ₦224.74 and ₦266.60.

The cost analysis showed that the Total Variable (TVC) per cubic metres (m^3) was largest for small scale sawmills and least for large scale sawmills. Also the Fixed Cost (FC) per cubic metres component was largest for small scale sawmills and least for the large scale ones, implying the large scale sawmills enjoyed economies of size, that is average cost of production declined with scale of operation.

The production function analysis showed that the coefficient on logs for processing was positive and significant at 5% level for all the scale of operation while that for labour was also positively significant at5% level for the large scale sawmills. Elasticities with respect to education, experience and operating expenses were negative decreasing functions to the factors for small scale sawmills, indicating their allocation and use were stage III of the production function. Whereas, the elasticities with respect to experience, labour and operating expenses in the medium scale sawmill were in stage II of the production surface, implying efficient allocation and use as explained by the estimated coefficients in stage II of the production region.

The Returns to scale analysis showed that small and medium sawmills were in the stage I(irrational zone) of production, their activities were not efficient where as large scale sawmills were in the rational zone (stage II) of production and thus efficient in their operation.

CONCLUSION

The study established that sawmilling was viable in the study area regardless of scale of operation and that log for processing and labour were the most limiting factors in sawmilling operations. Also, acquisition of forest area was the major source of wood in the sawmilling industry.

The profitability analysis showed that sawmilling was viable regardless of the scale of operation. .

The production function analysis showed that log for processing and labour were the most limiting factors in sawmilling operation.

RECOMMENDATION:

To further increase output and revenue from sawmilling operations those variables whose sign were different from a priori expectation should be addressed.

The study revealed that the sawmillers were well educated, yet the sign on the estimated coefficient was negative for all the scale enterprises. This could be due to their non-direct involvement in the day to day operations of the sawmill because they were involved in other things and thus relied on paid managers. The owners of the sawmill should stop being absentee sawmillers and pay more attention to the supervision of operations in the sawmills, if their output must increase.

The sawmillers in the medium and large scale enterprises should look at their cost structure and reduce areas of waste so that their revenue could increase and their operations becoming more profitable.

The small and medium scale enterprises should expand their operations in view of the available labour they have so that their operations could move from stage I to stage II of the production surface.

REFERENCES

Adenuga, B.O (1981) "Prerequisites for Effective Planning of Technology Transfer In Nigeria's Sawmilling Industry". A Paper presented at the Forestry Association of Nigeria Annual Conference, Akure, Ondo State. 25th-27th November, 1981.

Adenuga, B.O (1984). "Profitability of sawmilling Operation in Nigeria". A paper presented to a seminar at the Forestry Research Institute of Nigeria. Ibadan. (FRIN) 23rd May, 1984.

Adenuga, B.O and Omoluabi, C.A. (1980). "Sawmilling in Nigeria". Seminar on sawmilling For Developing Countries. Kotka, Finland. 15th September-3rd October, 1980.

Adewale, O.J(1988). A study on wood processing in some sawmills in Ondo state. Unpublished B.Tech. Thesis. Department of Forestry and wood Technology. Federal University of Technology, Akure.

Adeyoju, S.k.(1965). "The economic Importance of Wood Based Industries." Nigeria Journal of Economic and Social Studies. 2:309-326

Afolabi, A.A(1978),"Sawmilling in Nigeria" Proceeding of the Seminar on Planning of Sawmilling Industries in Africa. Arusha, Tanzania. Pp.341-365.

Agrawal,A.N . and Lal, K. (1977). Economic Planning. 2nd Revised Edition. Vikas Publication House PUT Limited, India.

Akindele, S.O and Fuwape, J.A.(1998). Wood –Based Industrial Sector or Review. A Consultancy Report prepared as part of the National Forest Resources Study. Nigeria. February 1998.

Aliver, G.O (1983). "Report of Forest Industries in Nigeria". Working Document. No.12a, FO; NIR/77/008. Federal Department of Forestry, Lagos.

Badejo, S.O. and Giwa, S.A. (1985). Technical Note. Forestry Research Institute of Nigeria (FRIN) Ibadan .No.50.1985.

Dare, A. (1979) " A Study of Lumber Production and Utilization in All African Wood Working Industry, ondo State." Unpblished B.Sc.Thesis. Department of Forest Resource Management, University of Ibadan.

Falusi, R.O. (1979). "Forestry in the Future Growth and Performance of Construction Industry in Nigeria.".The Nigeria Journal of Forestry. Forestry Association of Nigeria.Pp.63-72.

Food and Agricultural Organization (FAO) (1997). "Forestry Development of Nigeria." Project Findings and Recommendations. F.O.D/NIR71/546. Terminal Report. F.A.O of the Unite Nations Rome.Pp.88.

Fasuru, J.O.(1979)." Sawmilling in Nigeria; Past, Present and Future" Unpublished B.sc. Thesis. University of Ibadan. Pp.34-35.

Huuhtanen,H.J.(1975). Food and Agricuture Organization (FAO)/ United Nations Development Project (UNDP) High Forest Department Project. Federal Department of Forest, Nigeria.

Ifebueme, C.A.(1993)."Country Report on Nigeria forestry". Seminar paper on Planning and Maintenance of Integrated Mechnical Forest Industries.

Kai, C.(1981)." Sawmilling in Developing Countries". Proceedings of the Seminar on Sawmilling for Developing Countries, Kotka, Finland, pp.205.

Mc. Bride, C.F.(1963). "Sawing Small Diameter Logs." Department of Forestry of Canada-Forest Production Research Branch Contribution.pp.5

Nwokeabia, O.D.(1999). "Mechanical Forest Industries in Nigeria." Paper presented to a seminar on Small Scale Forest Industry. Forest Research Institute of Nigeria.

Ojo, S.O.(1999)."Investing in Human Capital: A veritable tool for the Development of Rural Economy" In the Book of Proceeding. Farm Children and Agricultural Productivity in the 21st Century. Edited by Williams S.B. and Ogbimi F.E. and Farinde, J.O.pp.346-350.

Okigbo, L.C.(1964)." Sawmilling in Nigeria." The Nigeria Journal of Forestry. Forestry Association of Nigeria (FAN) pp.64-65.

Olyide, S.O. and Heady, E.O.(1982). Introduction to Agricultural Production Economics. Ibadan University Press, University of Ibadan.

Oluwasusi, J.S.(1981)." The Impact of Sawmilling Industry on Resources in Ondo State." Unpublished HND Thesis, Federal School of Forestry. Forestry Research Institute of Nigeria Ibadan.

Sanwo, S.K .(1982)."An Evaluation of the Performance and Efficiency of Small Sized Sawmills in Oyo State". Nigeria Journal of Forestry. 12(2):16-25

Segun,K.A.(1969)."Some Impressions of Indigenous Sawmilling in Nigeria". Journal of Tree Club. University of Ibadan. No.5.June, 1969. Pp.29.

Sekene,B.P. (1989). "The Influence of Log Size on Productivity and Timber. Recovery Ratio in Sawmill in Akure Township". An Unpublished B Tech.Thesis. Department of forestry and Wood Technology, FUTA. Pp.24.

Seppo, P.A.(1980). "Sawmill Machinery and Maintenance". Proceedings of the Seminar on Sawmilling for Developing Countries. Kotka, Finland. 15th September-3rd October, 1980.

Strumulin, S.(1964). "The Economics of Education in the USRR". Economic and Social Aspect of Educational Planning, Paris. UNESCO.

Wahl,O. (1978). "Preplanning of Sawmills." Proceeding of Seminar on Planning of Sawmilling Industries. Arusha, Tanzania. Pp.33-35.

Wellwood, R.W.(1966). Report of Forest Industries in Nigeria. FAO/UNDP Rome pp.64.

APPENDIX

FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

RESEARCH TOPIC: ECONOMIC ANALYSIS OFSAWMILL INDUSTRY IN ONDO STATE

INTERVIEW SCHEDULE

This research questionnaire is for academic purpose. Your responses would be treated confidentially.

(A) DEMOGRAPHIC INFORMATION

1 Name of respondent _____

2 Age of respondent (please tick () one below)

i Below 20 yrs ( ) ii 21-30 yrs ( ) iii 31-40 yrs ( )

iv 41-50 yrs ( ) v 51-60 yrs ( ) vi 61-70 yrs ( )

71 and above ( )

3 Marital status (Please tick ( ) one below

i Single ( ) ii Married ( ) iii Widowed ( ) Divorced ( )

4 Position of the respondent in the mill _____

5 Sex: (I) Male ( ) (ii) Female ( )

6 Family Size: (a) Number of Wives _____

(b) Number of Children _____

(c) Number of dependants _____

level of education (Please tick ( ) the highest qualification)

(i) No formal Education ( ) (ii) Primary Education ( )

(iii) Secondary Education ( ) (iv) Technical College ( )

(v) Polytechnic ( ) (vi) University Education ( )

(vii) Adult Education /Literacy Classes ( )

8 (I) Do you engage in any other business apart from sawmilling operation

yes ( ) No ( )

(i) if yes, state the nature of job _____

B. **PRODUCTION ACTIVITIES**

9. How long have you been in the sawmill business (years) _____

10. Do you have any previous knowledge about sawmilling (Tick One)

Yes ( ) No ( )

11 Tick from the reasons below why you go into sawmill business

REASON	STRONGLY AGREE	AGREE	INDIFFERENCE	DISAGREE	STRONGLY DISAGREE
To serve as regular source of income					
To produce employment for me and family members					
To produce lumber for local consumption.					
To produce lumber for export					

12. What is your scale of operation (Tick One)

(i) Small Scale ( ) (ii) Medium Scale ( )

(ii) Large Scale ( )

13. Please tick ( ) the number of machines used

(i) 1 only ( ) (ii) 2-4 ( ) 5 and above ( )

14. How much is your total production between 1995 (please complete the table below)

YEAR		SIZES OF WOOD PRODUCED	PRODUCTION COST	QUANTITY PRODUCED	QUANTITY UNIT PRICE
1995	1				
	2				
	3				
	4				
1996	1				
	2				
	3				
	4				
1997	1				
	2				
	3				
	4				
1998	1				
	2				
	3				
	4				
1999	1				
	2				
	3				
	4				

15. Indicate the type of machine used for sawing operation _____

(c) INPUT USED

16. State the cost incurred in acquiring the land for your mill site.

17. (a) Tick the type of labour used in your sawmilling operation

(i) Family Labour (ii) Hired Labour ( )

(ii) Hired and family labour ( )

17(b) Tick the category of workers employed (I) Skilled ( ) (ii) Unskilled ( )

17(c) If skilled, specify their level of education by ticking (/) appropriate one (I) Primary Education ( ) (ii) Secondary Education ( )

(iii) Technical College ( ) (iv) Polytechnic ( )

18. Please indicate by ticking ( ) the total of workers employed in the sawmill.

(i) 1-10 workers ( ) (ii) 11-20 workers ( )

(iii) 21-30 workers ( ) (iv) 31-40 workers ( )

(iv) 41 and above. ( )

19 Do you have forest area where you get logs (Tick One)

Yes ( ) No ( )

20 if yes, what is the size of your forest area (in hectare) ————

21 please give the following information about the labour used in your forest area in 1998.

Operation	family labour		Hired labour			Total cost
	No of people	No of days	No of people	No of days	Amount paid per person per day	
i Road Making ii Felling operatrion iii Transportation to the yard iv processing						

22 If you do not have forest area, how do you obtain wood (tick one)

(i) From Forest allotee ( ) (ii)Buyer from forest allotee (Middlemen) ( )

(iii) Purchase from the field (i.e. other sawmillers) ( ) (iv) Free areas ( )

23 If wood round log is obtained from forest or purchase from the source(s) mentioned above, please complete the table below.

Wood Species	Volume of wood brought to the mill	Quality unit prices /m^3	Volume of wood processed (m^3)	Total Cost

24 Indicate the quantity and amount spent on the following items during sawing operation (per annum)

Items	Quantity	Quantity unit price	Total
i Lubricant (e.g) engine Oil (in litres)			
ii Fuel e.g petrol/diesel (litres)			
ii. Electricity			
iii. Sawblade			

(D) MARKETING CHANNELS

25. please tick ( ) from the list below ways of selling the lumber produced:

(i) To wholesaler or exporters ( ) (ii) To Retailer ( )

(iii) Directly to the consumers ( )