



## SENSITIVITY ANALYSES OF FURNITURE PARTS PRODUCTION FROM SAWN WOOD IN A VERTICALLY INTEGRATED SAWMILL

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### ABSTRACT

The study evaluated the impact of production and market changes on the revenue generated from processing of sawnwood to furniture parts in a vertically integrated sawmill and its impact on profit to the producers. Production Costs (PC) per cubic meter of furniture parts produced was determined from the cash flow and the Rate of Returns on Investment (RORI) was calculated to determine the rate at which the money invested on the enterprises could be realized. Sensitivity analysis was carried out to assess the effect of production cost and revenue changes on the (RORI) when price of inputs increases or revenue decreases. The result revealed that the enterprise was viable at RORI >25.0% when the cost of production was increased by 30.0%, a 25.0% reduction in revenue of the enterprise was also viable with RORI 22.0%. The study showed that when policies such as timber allocation right that would help the sawmillers to improve on their production level through vertical integration are put in place it will go a long way in sustaining furniture part production for export because the average current bank interest rate for investments based in Nigeria is 22.0%, production of furniture parts will therefore compete profitably even if investment on capital is sourced from the banks at the current interest rate.

**KEYWORDS:** Sensitivity analysis; Economic evaluation; sawnwood; furniture parts.

### INTRODUCTION

The Nigerian government policy on forest industries currently is to increase the domestic value in the processing of wood products and has thus put a ban on the export of logs, rough sawn and clean sawn wood except processed wood. These measures were put in place to make raw materials locally available for secondary processing mill to achieve the desired value-addition for export. Further processing of timber will ensure economic value of timber and other forest products to be fully harnessed (Larinde *et al.*, 2010). It will also reduce the ecological impacts of utilization on the forests for sustainable management. The wood-based industry in Nigeria suffers from production inefficiency as a result of poor integration, poor cost and returns database and non reinvestment of profit (Larinde, 2008). The manufacture of further processed product is an instrument for economic development, capable of mobilizing latent resources and promoting the expansion of forest industries because of its foreign exchange earnings and savings potential. This is because the product of this industry has wide market in Europe. Jukka (2001) stated that a vibrant, high-value timber processing is the only panacea for tropical forestry's strong presence in export market. Furniture component manufacturing are gradually being integrated with existing sawmills in Nigeria to increase value addition to sawn timber as well as provide essential material for the furniture and building industry. Unfortunately, techno-economic appraisal of value-addition to sawn timber is scanty because of few numbers of producers. Many sawmills could not rationalize the investment outlay for further processing. Nevertheless, information is required on factors leading to the best

operating performance mode within existing laws and regulations. Conducting a sensitivity analysis ensures that the producers make better and more informed decisions by changing assumptions and observing or estimating the results, and also to predict the outcome of such decisions. Laidre (2012) described sensitivity analysis as a brainstorming technique involving identifying activities and potential factors that could affect the outcome of those activities. It also involves generating "what if" questions to determine how the activity will be affected by different scenarios. The analysis is used for treating uncertainties; it is an inherent companion of projects and ex ante assessments (FAO, 1992). Sensitivity analysis is a technique used to determine how different values of an independent variable will impact a particular dependent variable under a given set of assumptions. This technique is used within specific boundaries defined by one or more input variables, e.g the effect that changes in input cost will have on a sale's price. Sensitivity analysis is very useful when attempting to determine the impact the actual outcome of a particular variable will have if it differs from what was previously assumed. By creating a given set of scenarios, the analyst can determine how changes in one variable will impact the target variable. Nigeria must be sensitive to changing patterns of wood usage and demand levels so as to remain relevant in tropical wood supply trade and also meet the demand of future wood requirements. The restrictions on exports of logs and primary products through prohibition by government can be sustained through the generation of investment capital for domestic industry development. Log export rights should of necessity be linked to local investment in further processing. It may be important to assess the sensitivity of

increasing cost of inputs and decreasing revenue from the furniture parts production in order to determine the impact of the changes and uncertainties on the business. This will help determine the profit of the enterprise and the risk factors associated with the manufacture of furniture parts from sawn wood.

## METHODOLOGY

Variables that affect mill production cost include raw material input, capital expenditure, energy, wages and salaries. Monthly records of these items were collected for 48 months. In the financial analysis, existing market prices are used for all inputs and outputs. Nonmarket effects (externalities or indirect effects) are not valued in the financial analysis, since they do not enter into the cash flow table of the financial entity. The market price (FOB) is the amount of money which a buyer (consumer) has to pay at a given time in a given market for the good or the amount of money which the seller of a good or service receives in the market. The term *FOB* means *free on board* and includes all costs to get goods on board the ship in the harbor of the exporting country, such as, company gate prices, local marketing and transport costs, local port charges and export tariffs and subsidies. Whereas the sensitivity analysis was based on how market conditions, and other considerations affect the final magnitude of the profit. Some adjustments in observed prices and trends in such prices were made. Adjustment was made for relative price changes for inputs and outputs; Values used involve consideration of future supply and demand conditions. Capital input was measured by depreciating the firm's capital assets using declining balance method. The average current bank interest rate for investments based in Nigeria of 22.0% as approved by Central Bank of Nigeria (CBN, 2012) was used. The production costs and prices per cubic meter of furniture parts were used for estimating the

cost/m<sup>3</sup>, price/m<sup>3</sup> of the furniture parts produced and the profit/ m<sup>3</sup>. Sensitivity analysis of Rate of Return on Investment (RORI) furniture parts of 1m<sup>3</sup> with increasing the costs from +10 to +35percent and decreasing revenue from -10 to-35 percent were tested.

## Data Analyses

Analysis of costs and returns include:

(a) Variable Cost (VC) - Wood raw material, Labour wages and salaries, energy in form electricity and diesel, water and petrol for transportation.

(b) Fixed Cost (FC) -Depreciation of structures (buildings) and machinery.

(c) The Declining balance method of depreciation was adopted in the study.

Declining balance depreciation was calculated using the following formula:

Depreciation = Depreciation Rate  $\times$  Book Value of Asset

Depreciation rate is given by the following formula:

Depreciation Rate = Accelerator  $\times$  Straight Line Rate

(d) Revenue was calculated using the equation:

$$Rv = Sv - Cv$$

Where  $Rv$  = Revenue

$Sv$  = Selling Cost

$Cv$  = Production Cost

(e) Rate of return on Investment (RORI)

$$RORI = \frac{TR - TC}{TC} \times 100$$

Where TR = Total revenue (Selling Price)

TC = Total Cost (Cost Price)

## RESULTS & DISCUSSION

The manufacturing cost structure for the furniture part processed wood industry is presented in Table1.

**TABLE 1:** Cost Analysis of Furniture Parts Production

Item	Value (N)	
Returns/ cubic meter	81,000.00	
Furniture parts (Total Revenue)/cubic meter	81,000.00	
Input		Percentage (%)
(A) Variable Cost		
Wood	9,103,350.00	72.71%
Electricity	125,254.20	1.00%
Diesel	346,365.24	2.76%
Petrol	216,948.72	1.73%
Water	17,175.00	0.14%
Auxiliary materials	60,637.56	0.48%
Salaries & Wages(Labour)	1,990,449.60	15.89
Total Variable Cost	11, 860,180.32	94.74%
(B) Fixed Cost		
Capital Depreciation	659,057.40	
Total fixed cost	659,057.40	5.26%
Total Cost	12,519,237.72	100.00%

The major determinants are wood raw material, cost of labour, capital depreciation, and cost of diesel, petrol and electrical energy. While the total cost of production was ₦ 38,656.33/m<sup>3</sup> at a selling cost of ₦ 81,000/ m<sup>3</sup> the Profit is ₦ 42,343.67/m<sup>3</sup> excluding forwarding cost (since the product is sold in the international market) and Tax. At forwarding cost of ₦ 11,000/m<sup>3</sup> the profit before Tax was

₦ 32,343.67/m<sup>3</sup>. The study revealed that wood raw material accounted for about 72.71% of the total cost of production. The share of labour cost (salaries and wages) was 15.89%, energy in form electricity and diesel purchased also contributed (3.76%) to the total cost of production. The contribution of energy from diesel engine and national grid were 2.76% and 1.00% respectively. The

overall profitability of the industry will be enhanced if labour cost could be minimized in the industry through automation of process whereby lumber are moved by conveyor belts and electric power is more stable from the national grid. Fixed cost (depreciation of equipment and buildings) represented 5.26% of the total cost of the furniture parts produced by the industry.

Production Cost (PC)

PC= Total cost/ Output

$$= \text{₦ } 12,519,237.72 / 323.86\text{m}^3$$

$$= \text{₦ } 38,656.33 / \text{m}^3$$

$$\text{Production cost} = \text{₦ } 38,656.33 / \text{m}^3$$

$$\text{Selling cost in Naira} = \text{₦ } 81,000 / \text{m}^3$$

Revenue is calculated using the equation:

$$Rv = Sv - Cv$$

Where  $Rv$  = Revenue

$Sv$  = Selling Cost

$Cv$  = Production Cost

$$\text{₦ } 81,000 / \text{m}^3 - \text{₦ } 38,656.33 / \text{m}^3 = \text{₦ } 42,343.67$$

$$\text{Profit} = \text{₦ } 42,343.67$$

Profit here excludes Forwarding cost (since the product is sold in the international market) and Tax.

Forwarding: these include palletizing, stuffing, transport, custom clearance, shipping coy charges and NPA charges (Adeofun and Akande, 1990).

$$\text{Forwarding cost} = \text{₦ } 11,000 / \text{m}^3$$

$$\text{Thus Profit before Tax} = \text{₦ } 81,000 / \text{m}^3 - (\text{₦ } 38,656.33 / \text{m}^3 + \text{₦ } 11,000 / \text{m}^3) = \text{₦ } 32,343.67 / \text{m}^3$$

Profit before Tax=  $\text{₦ } 32,343.67 / \text{m}^3$ . Popoola, (1999) noted that there are tax holiday of three years for newly formed manufacturing industries in Nigeria, this is government policy to encourage industrialization of the economy.

Rate of return on Investment (RORI)

$$\text{RORI} = \frac{\text{TR} - \text{TC}}{\text{TC}} \times 100$$

Where TR = Total revenue (Selling Price)

TC = Total Cost (Cost Price)

$$= \frac{\text{₦ } 81,000.00 - \text{₦ } 49,656.33}{\text{₦ } 49,656.33} \times 100$$

$$= 63.12\% - 22.0\% (\text{Interest rate})$$

$$= 41.12\%$$

#### Sensitivity analysis of Rate of Return on Investment

The rate of returns on investment of wooden furniture part production showed a high returns in the enterprise (41.12%) assuming invested capital was loaned. Interest rate of 22.0% on loans for commercial business as approved by Central Bank of Nigeria was used to compute the RORI, (CBN, 2012). The average current bank interest rate for investments based in Nigeria is 22.0%, production of furniture parts will therefore compete profitably even if investment on capital is sourced from the banks at the current interest rate. The rate of return on investment for the furniture parts was subjected to a sensitivity analysis to establish the point at which profitability is not certain. In respect of the input, increasing the costs from +10 to +30percent did not significantly impact rate of return on investment (Table 4). The result further revealed that at 35% increase in cost of production, the rate of return on investment dropped to 20.85%. When compared with the minimum lending rate of 22.0% in most commercial bank in Nigeria the enterprise is not viable and might not be recommended if investment will be financed by bank loan. At the calculated revenue, the rate of return was 63.12% but when the revenue was reduced by 10percent rate of return dropped to 46.80%, at 25percent drop in revenue, rate of return dipped to 22.34% (Table 5). Therefore for the enterprise to remain profitable the decrease in revenue should not go beyond 25%.

**TABLE 4:** Sensitivity analysis of Rate of Return on Investment furniture parts of  $1\text{m}^3$  (Increasing Cost)

VARIABLE RORI	COST	REVENUE	RORI	REMARK
Actual cost	49,656.33	81,000.00	63.12%	Actual estimate
+10% cost	54,621.96	81,000.00	48.29%	Recommended
+15% cost	57,104.77	81,000.00	41.84%	Recommended
+20% cost	59,587.59	81,000.00	35.93%	Recommended
+25% cost	62,070.41	81,000.00	30.49%	Recommended
+30% cost	64,553.22	81,000.00	25.47%	Recommended
+35% cost	67,036.04	81,000.00	20.85%	Not Recommended

**TABLE 5:** Sensitivity analysis of Rate of Return on Investment furniture parts of  $1\text{m}^3$  (Decreasing revenue)

VARIABLE RORI	COST	REVENUE	RORI	REMARK
Actual cost	49,656.33	81,000.00	63.12%	Actual estimate
-10% revenue	49,656.33	72,900.00	46.80%	Recommended
-15% revenue	49,656.33	68,860.00	38.65%	Recommended
-20% revenue	49,656.33	64,800.00	30.49%	Recommended
-25% revenue	49,656.33	60,750.00	22.34%	Recommended
-30% revenue	49,656.33	56,700.00	14.18%	Not Recommended
-35% revenue	49,656.33	52,650.00	6.0 %	Not Recommended

## CONCLUSION

Furniture parts production is a new frontier of vertical sawmills integration in Nigeria. It has contributed to livelihood improvement by providing job opportunity, income generation and intermediate raw materials to furniture industry at home and abroad. Furniture parts productions have huge trade transactions and income generating potentials. In order to sustain the expanding trade in future, some adjustments in observed prices and trends in such prices were made. The viability of the enterprise is not in doubt. This study affirmed that furniture parts productions in a vertically integrated sawmill is profitable because it has RORI >25.0% when the cost of production was increased by 30.0%, at 25.0% reduction in revenue of the enterprise was also viable with RORI 22.0% when compared with the money lending rate in Nigeria commercial banks. The study showed that furniture parts production can adjust positively to incidentals such as general price inflation and relative price changes for inputs and outputs that may occur in time. Vertically integrated secondary wood processing units from Nigerian sawmilling industry will go a long way in meeting the rapid industrialization required in the present day manufacturing sector of the economy.

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