International Journal of Engineering and Advanced Technology Studies

Vol.10, No.2, pp.1-15, 2022

ISSN 20535783(Print)

ISSN 20535791(online)

Improvement of Asphalt Production Investment in Nigeria Through Profitability Assessment: A Case Study of Oyo State Nigeria Construction Company

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Citation: Melodi Mbuyi Mata, Blessing Olamide Taiwo, Lateef Bankole Adamolekun (2022) Improvement of Asphalt Production Investment in Nigeria Through Profitability Assessment: A Case Study of Oyo State Nigeria Construction Company, *International Journal of Engineering and Advanced Technology Studies*, Vol.10, No.2, pp.1-15

ABSTRACT: *This study assessed the profitability of asphalt production in Oyo State, with an objective to improve the performance of revenue, and determine the profitability of asphalt production. Quantitative method was used for the collection of secondary data for the range of one year between august 2018 to July 2019. Descriptive statistics using charts, table, mean, depreciation, and inferential statistics using t-test and p-test was adopted. The t-test result shows that there is significant difference in granite production revenue trend yearly. The gross profit margin gives the fact that for each ₦100 a profit of 56.4% is made. The Net Present Value (NPV) gives a positive profit of ₦10,814,300 indicating profit gained within the period of August 2018 to July 2019. The positivity of the net present value is a chance for investors to invest in this kind of business which will also increase productivity, efficiency and a greater output.*

KEYWORDS: asphalt, revenue improvement, profitability, depreciation, efficiency, net present value

INTRODUCTION

Naturally occurring deposits of bitumen are formed from the remains of ancient, microscopic algae and other once-living things. When these organisms died, their remains were deposited in the mud on the bottom of the ocean or lake where they lived. Under the heat and pressure of burial deep in the earth, the remains were transformed into materials such as bitumen, kerogen, or petroleum deposits (Murali, 2006). Bitumen is a black or dark-colored (solid, semi-solid or viscous) cementitious substances, natural or manufactured, composed principally of high molecular weight hydrocarbons (Murali, 2006).

Granite is an igneous rock made up of primarily quartz, feldspar, micas, amphiboles, and a mixture of additional trace minerals. These minerals and their variation in abundance and alteration give granite the numerous colors and textures we see in granite countertops (Haldar and Josip, 2014). Mineralogically, granite is a plutonic rock that is composed of between 10 to 50% quartz (typically semi-transparent white) and 65 to 90% total feldspar (typically a pinkish

or white hue) most granite intrusions are emplaced at depth within the crust, usually greater than 1.5 km and up to 50 km depth within thick continental crust (McGill, 2007). According to Haldar and Josip, (2014), granite are usually a white, black or buff color and are medium to coarse grained, occasionally with some individual crystals larger than the groundmass forming a rock known as porphyry. It can be pink to dark gray or even black, depending on their chemistry and mineralogy. Outcrops of granite tend to form tors, rounded massifs, and terrains of rounded boulders cropping out of flat, sandy soils.

Granites sometimes occur in circular depressions surrounded by a range of hills, formed by the metamorphic aureole orhornfels (McGill, 2007). Granite is nearly always massive, hard and tough, and it is for this reason it has gained wide spread use as a construction stone. Aggregates had been known as industrial material for many decades and comprise of a lot of composite materials. Mostly, they are mined materials that are broken down into different sizes for construction applications. There are many geological characteristics that affect the mining of crushed stones and gravel (Barksdale, 1991).

However, the most common mining methods are the open pit mining and quarrying. Quarrying requires drilling and blasting for size reduction. After the suitable method is applied the crushed rock is transported to the process facilities. As stated by Hunter (2000) processing plants are available i different types. Here, the quarried rock undergoes primary and secondary crushing and is sorted in size and is moved by the conveyors to bins or stockpiled (Hunter, 2000). Aggregates are widely considered to be inert materials; however, they are not as their characteristics can change over days, months and years. Aggregates use in asphalt production can be divided into three main classes.

The first class is the naturally occurring aggregate which composed of four rock types which are igneous, sedimentary, metamorphic, or sand and gravel. Natural aggregates include aggregates produced from quarrying, excavating from land deposits and dredging from rivers or marine deposits (Hunter, 2000). The second group of aggregates is artificial aggregates which for example can be the waste material from steel production or other manufacturing processes. The last group of aggregates are those recycled. Historically, there has been little interest in recycled aggregate however due to an increased awareness of environmental issues and technological improvements this final group is becoming a major source of aggregates. One factor that has to be considered in recycled aggregates is whether they still retain enough strength after up to 30 years of use (Hunter, 2000).

An important aggregate property is gradation which is the distribution of aggregate particle size expressed as a percentage of the total aggregate mass. Gradation of aggregates is achieved using sets of sieves. Gradation is considered one of the most important aggregate properties as it has a large impact on processes that use aggregate such as Hot Mix Asphalt (HMA) plants, and the resulting asphalt. Roberts *et al* (1991) indicated that tightly packed aggregate consisting of various particle sizes that leave few voids between particles results in little or no air voids between the aggregate. This leaves little or no room for the bitumen binder however if the gradation is poor in the aggregate mix this will lead to large air voids. The resulting asphalt will be too weak and more bitumen will be used to bind the aggregate (Roberts *et al.*, 1991). Aggregates are graded dependent on their size which is done post crushing by passing the flow of aggregate material over upper and lower sets of limiting sieves. The energy and related cost to dry aggregate are dependent on the specific and latent heats of water and also the specific heat of the aggregate type that are used in asphalt production.

In Nigeria, 44% of all goods are moved by trucks over roads and 85% of all people are transported by cars, buses or coaches on roads. Road transport remains one of the strategic sectors of Nigeria's economy. Emmit and Gorse, (2003) stated that the principal requirements of a good economy in terms of transportation includes; safety and comfort, ease of use and operation, ease of maintenance, periodic repair and replacement, adaptability and durability, ability to recycle materials and components. The vast economic potentials of the mining sector in Nigeria where government holds all mineral rights has been widely reported for extraction processes, despite Nigeria being a country with the second largest deposit of bitumen in the world. According to Foraminifera (2006) a firm spends a lot yearly on importation of asphalt materials which is mostly bitumen. The occurrence of bitumen deposits in Nigeria is twice the amount of existing reserves of crude petroleum. When fully developed, the industry will no doubt meet local requirements for road construction and also become a foreign exchange earner for the country.

Eighty per cent of asphaltic materials used for road construction in the country are still being imported despite the vast bitumen deposit. In Nigeria priority need to be given to investors to build processing plants, boost local production, help meet local demand and create jobs for youths. The use of aggregates from the mining operation in the production of asphalt mixtures needs to be encouraged. Nevertheless, there are some concerns and uncertainties about the actual environmental, economic and mechanical performance resulting from the incorporation of aggregates, bitumen and dust in asphalt mixtures (Martinho *et al.*, 2012). Production of asphalt is cost efficient, reduction in noise pollution and comfort, increased mobility for people, goods and services.This form the base of important for this research as the assessment of asphalt profitability will encourage investors to grab the vast opportunity for production.The studies assess the profitability of asphalt production including the mining, crushing and grinding of the granite in Oyo state. Profitability is a significant indicator in assessing the economic and financial performance of asphalt because the cost of production keeps rising. In

spite of the relevance of production of asphalt to the economy, very few published studies have been carried out to assess the profitability of asphalt production.

Location and Geological setting

Oyo state is an inland state in south-western Nigeria located on 8°7'10.56" Northing and 3°25'10.56" Easting, with its capital at Ibadan. It is bounded in the north by Kwara State, in the east by Osun State, in the south by Ogun State and in the west partly by Ogun State and partly by the Republic of Benin. Oyo State covers approximately an area of 28,454 square kilometers and is ranked 14th by size.

The study area is located at Olonde village, Oluyole Local Government in Ibadan (capital of Oyo sate) as shown in Figure 1. It has the coordinates of 7° 17.9' 20" N 3° 54' 20" E in the south-western part of Nigeria. It shares boundaries with four Local Governments, which are: Ibadan South West, Ibadan South East, Ona Ara Local Government and Ido Local Government, all within Ibadan metropolis. It also shares boundaries with Ogun State through Obafemi Owode, Odeda and Ijebu North Local Governments. Its headquarters are in the town of Idi Ayunre.It has an area of 629 km². It comprises of granite in different areas such as Aba-nla, Idi-ayunre but granite occurs mostly at Olonde.

RESEARCH METHODOLOGY

Quantitative methodology emphasizes objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires and surveys or by using pre-existing statistical data using computational techniques. In order to determine the profitability of asphalt production, factors such as the explosives, bitumen, dust, haulage was considered. The company granite aggregate and asphalt production and income revenue was monitored for two years. Independent test was use to compare the revenue generated between the two years production both for the granite and asphalt production. The profitability of both mining business was evaluate using Net profit value.

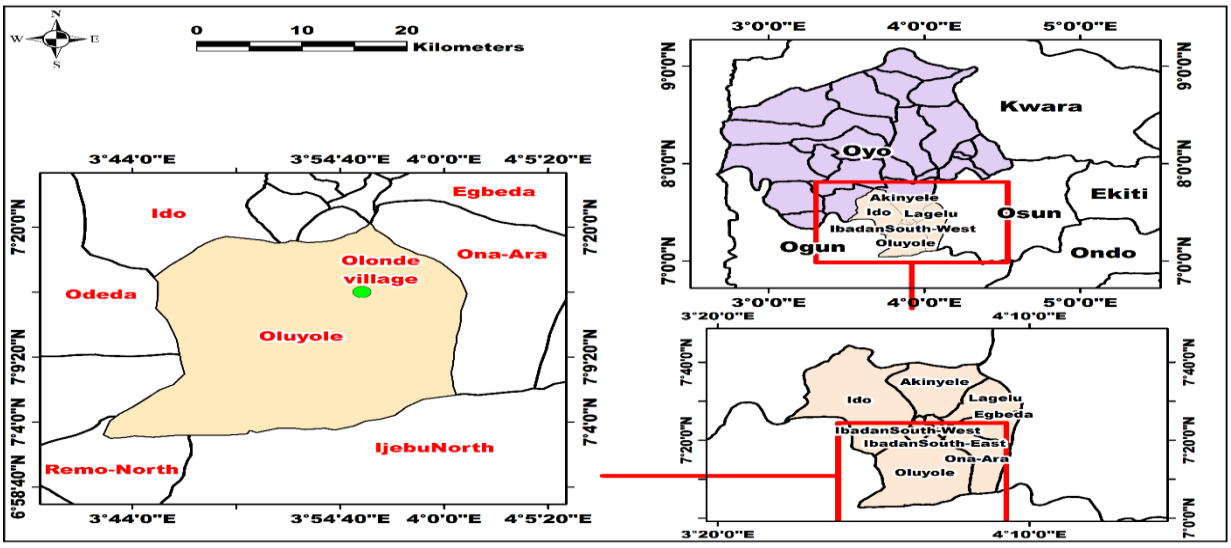

Figure 1. Geological Map of the study area (After, Ordnance (2018)

Data Collection and Sampling

Data for this study was collected from a secondary source. The quantitative information gotten includes the revenue from the production, the amount spent on the explosives, dust, bitumen, fuel, electricity, machinery and plants used for production.

Data Analysis

The data collected were used to determine the capital cost, production cost, total revenue, profit.

Determination of Total Fixed Cost (TFC)

According to Baumol and Bradford, (1970) the fixed costs are cost that are independent of output, these remain constant throughout the relevant range are usually considered sunk cost, the company pay these even if they shut down. Example of fixed costs are rental cost of building, cost of leasing and purchasing capital equipment, the annual business rate charge by local authorities, the cost of employing full time contracted staff, the cost of meeting interest payment on loans, the depreciation of fixed capital and the cost of business insurance. The company total fixed cost was determined from direct assessment.

Determination of Total Variable Costs (TVC)

Variable costs are explain to be the cost that vary directly with output, when output is zero, variable cost will be zero but as production increases, total variable costs increases, it increases at a constant rate to labour and capital, example of variable costs are cost of raw materials used for production, for example: cost of explosives materials and other blasting accessories, wages of part time stall or employee paid by hour, cost of electricity or cost of supply power by diesel generator, the depreciation of capital input due to wear and tears. The total variable cost was determined by adding all the company variable costs together (Hochbaum and Segev, 1989).

Determination of Total Cost (TC)

Total cost is the addition of total fixed costs and total variable costs and is calculate using Equation 1-3.

$$TC = TFC + TVC \quad (1)$$

Also, total fixed and variable costs can be calculated from total cost as follows

$$TFC = TC - TVC \quad (2)$$

$$TVC = TC - TFC \quad (3)$$

Where, TC is Total Cost, TFC is Total Fixed Cost, and TVC is Total Variable Cost

Determination of Total Revenue

The total revenue generated by the company for one year was calculated by multiplying the total tonnages of aggregates and asphalt produced at the end of each production month by the average selling price per ton of aggregate and asphalt. The total revenue for production is calculated using Equation 4.

Total Revenue = total tonnage × price (4)

Depreciation

Kaldor and Mirrlees (1971) noted that reduction in the value of an asset over time, due in particular to wear and tear. Depreciation is gives an accounting approach for allocating the cost of a tangible or physical asset over its useful life or life expectancy. A decrease in an asset's value may be as a result of other factors as well as unfavorable market conditions, etc. Machinery, equipment, currency are some of the company assets that are given priority for depreciate over a specific period. The formula for depreciation used in this study is written in Eq.5.

$$\text{Depreciation} = \frac{current\ worth}{expected\ life - current\ age} \times \frac{1}{12} \quad (5)$$

Gross Profit Margin

Gross profit margin is a metric used to assess a company's financial health and business model by revealing the amount of money left over from sales after deducting the cost of goods sold. The gross profit margin is often expressed as a percentage of sales and may be called the gross margin ratio. Gross profit margin is calculated by subtracting cost of goods sold (COGS) from total revenue and dividing that number by total revenue. The formula for gross profit margin is given in Eq. 6.

$$\text{Gross profit margin} = \frac{revenue - cost\ of\ good}{revenue} \times 100 \quad (6)$$

Net Present Value Method

The net present value (NPV) is an important criterion for project appraisal (Kumar, 2016). Kumar (2016) indicated that, NPV is calculated by using appropriate rate of interest which is the capital cost of the firm. This is the minimum rate of expected returns likely to be earned by the firm on investment proposals. The NPV is calculated using Equation 7-9.

$$\text{NPV} = \frac{R_t}{(1+i)^t} \quad (7)$$

Where, R_t, is the net cash flow i.e. cash inflow – cash outflow, at time *t*., t is the time of the cash flow, and i is the discount rate.

The result of this formula is multiplied with the Annual Net cash in-flows and reduced by Initial Cash outlay the present value but in cases where the cash flows are not equal in amount, then the previous formula will be used to determine the present value of each cash flow separately (Kumar, 2016).

$$\text{NPV (I, N)} = \sum_{t=1}^{N} \frac{R_t}{(1+i)^t} \quad (8)$$

Where, N is the total number of periods, and R is the net cash flow

$$\text{NPV (i, N, R)} = R\left(\frac{1-\left(\frac{1}{1+i}\right)^{N+1}}{1-\left(\frac{1}{1+I}\right)}\right); i \neq 0 \quad (9)$$

NPV analysis is a form of intrinsic valuation and is used extensively across finance and accounting for determining the value of a business, investment security, capital project, new venture, cost reduction program, and anything that involves cash flow. NPV analysis is used to help determine how much an investment, project, or any series of cash flows is worth (Kumar, 2016). It is an all-encompassing metric, as it takes into account all revenues, expenses, and capital costs associated with an investment in its Free Cash Flow (FCF). In addition to factoring all revenues and costs, it also takes into account the timing of each cash flow that can result in a large impact on the present value of an investment. For example, it's better to see cash inflows sooner and cash outflows later, compared to the opposite (Kumar, 2016).

(1) When inflows exceed outflows and they are discounted to the present, the NPV is positive. The investment adds value for the investor.

(2) When NPV is negative. If the net present value of a project or investment is negative it means the expected rate of return that will be earned on it is less than the discount rate (required rate of return or hurdle rate). This doesn't necessarily mean the project will lose money, it may very well generate accounting profit (net income),

(3) NPV of 0 means there is no change in value from the investment.

RESULTS AND DISCUSSION

Summary statistics for the revenue from asphalt and granite stone production is given in Table 1 from the month of August 2018 to the month of July 2019. Total revenue is the total receipts from sales of the granite and the asphalt; it was calculated by multiplying the tonnage by the price. The mean monthly revenue was calculated by the total revenue divided by the twelve months that this study covers. The price and the tonnage varies for these months, the number of tons varies because it depends on the tonnage required by the customer, the maximum amount of tonnage for the granite is 2048 tons at a price of ₦2300 per tonnage in August 2018 and the minimum is 108 tons at a price of ₦2400 in April 2019. For the asphalt production the minimum number of tons produced was 379 tons at a price of ₦22,500 in July 2019 and the maximum number of tons was 1516 tons at the same price in February 2019.

Table 1. Revenue from Asphalt and Granite Production

Year	Month/year	Granite (₦)	Asphalt (₦)	Sum (₦)
2018	August	4,710,400	23,400,000	28,110,400
	September	4,968,000	19,227,000	24,195,000
	October	4,287,200	13,182,000	17,469,200
	November	3,882,400	14,294,000	18,176,400
	December	2,548,400	8,989,500	11,537,900
2018 mean revenue		4,079,280	15,818,500	19,897,780
2019	January	2,448,000	10,395,000	12,843,000
	February	1,948,800	34,110,000	36,058,800
	March	967,200	29,385,000	30,352,200
	April	259,200	17,145,000	17,404,200
	May	1,483,200	14,535,000	16,018,200
	June	523,200	17,910,000	18,433,200
	July	2,304,000	8,527,500	10,831,500
2019 mean revenue		1,421,289	21,114,000	22,535,289
Total revenue		**30,330,000**	**211,100,000**	**241,430,000**
Monthly mean (’18 - ’19)		**2,527,500**	**17,591,667**	**20,119,167**

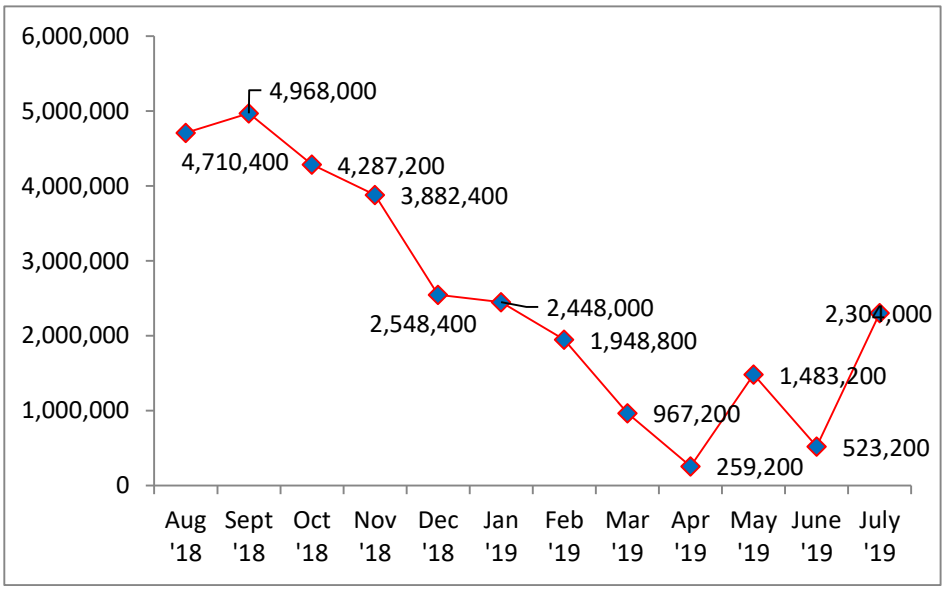

Figure 2. Trend of Revenue from Granite Production (Aug 2018 to July 2019)

Figure 2 shows the trend of revenue for the granite production. The highest production revenue was recorded in the month of August 2018 as ₦4,710,400 while the least revenue was recorded in April 2019 which gives the amount of ₦259,200. There was also small revenue generated in June 2019 at an income of ₦523,200 (Figure 2). This also shows that great increase in the income was recorded in 2018. The revenue decreased rapidly within the month of November 2018 to June 2019 but there was increase in July 2019.

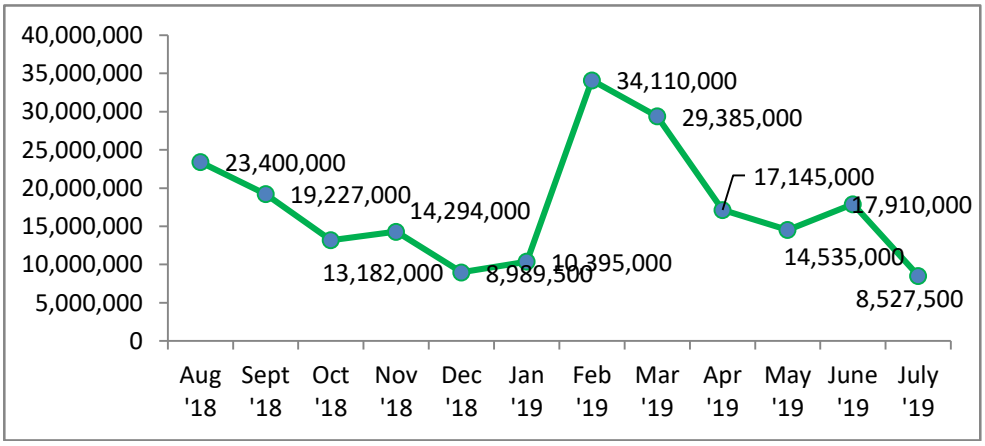

Figure 3. Trend of generated Revenue from Asphalt from August 2018 to July 2019

Figure 3 present the trend of revenue recorded for asphalt production. The biggest revenue from asphalt production was recorded in February 2019 with an income of

₦34,110,000. The least revenue was in July 2019 with an income of ₦8,527,500, also in December 2018 recorded small revenue which was ₦8,989,500.
The variation in revenue generation as shown in Figure 3 was noted to be as a result of large increase in the price range which was constant from January 2019 to July 2019.

Comparison between Granite aggregate revenue and asphalt production for two years

Independent test was used to compare the mean revenue from granite stone production in 2018 and 2019 the result is as presented on Table 2. The H_o was accepted, was state that the mean revenue from 2018 granite stone production trend is significantly higher than the mean revenue from granite stones production in 2019 at 5% level of significance ($p = 0.004$, $t = 5.804$). This may have been as a result of protracted downtime or inadequate production equipment or personnel and also be as a result of customer's demand.

Table 2. Comparison between revenue from granite in 2018 and 2019

Year	Mean Revenue	Std. deviation	T	P-values
2018	4,079,280	950,490	5.804	0.004
2019	1,421,289	850,424		

$p<0.05$

Table 3. Comparison between revenue from asphalt in 2018 and 2019

	Mean Revenue	Std. deviation	T	P-values
2018	15,818,500	5,590,337	-1.008	0.370
2019	21,114,000	10,139,500		

$P>0.05$

Table 3 presents the results of independent sample t-test of difference in revenue from asphalt by the asphalt company. No significant difference was noted in asphalt production in the two years (2018 and 2019) of study, $P>0.05$. This implies that 2018 mean asphalt production trend is not significantly different from 2019 mean asphalt production at 5% level. The similarity trend could be as a result of invariability in mechanical issues, customer's demand, and increase in selling price.

Evaluation of Asphalt production profitability

Table 4. Cost Incurred in Simultaneous Production of Granite Stone and Asphalt

Production variables	**Mean per month (₦)**	**% of Total Cost**
Total Revenue	20,119,167	
Variable cost		
Salaries	2,400,000	27.4
Wages	900,000	10.3
Fuel: diesel	80,700	0.9
Petrol	38,700	0.4
Electricity	230,000	2.6
Equipment maintenance	25,000	0.3
Explosives	75,000	0.8
Detonators	71,680	0.8
Health care	20,800	0.2
Remuneration and compensation	50,000	0.6
Bitumen	51,200	0.6
Dust	48,300	0.6
Total variable cost	3,991,380	45.5
Fixed cost (depreciation)		
Building	370,370	4.2
Equipment	466,700	5.3
Plant/machinery	1,656,900	18.9
Trucks	1,730,800	19.7
Land	548,000	6.3
Total fixed cost	4,772,770	54.5
Total cost	8,764,150	
Gross profit margin	56.4%	

Table 4 shows the total revenue, variable cost, fixed cost, %total variable cost and the total cost (sum of total variable cost and total fixed cost). The variable cost includes; salary, wages, fuel (diesel, petrol), electricity, equipment maintenance, explosives, detonators, health care, remuneration and compensation, bitumen, dust as present in Table 4.

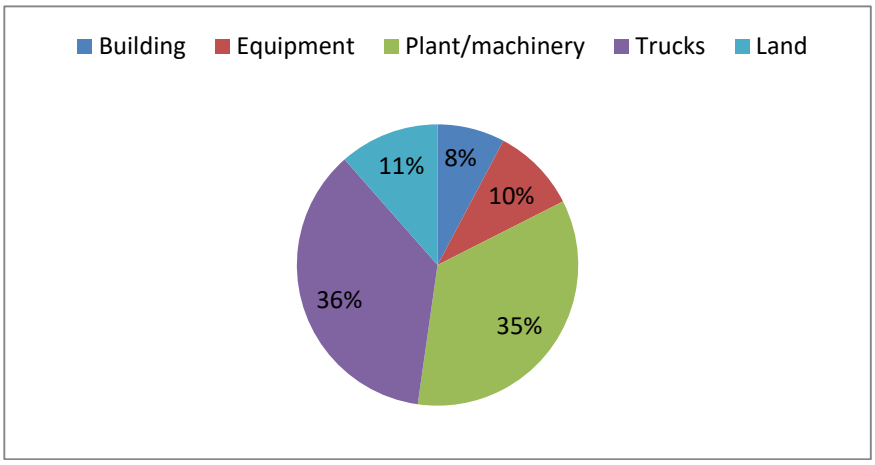

Figure 4. Pie chart presentation of granite/asphalt production Fixed cost

As shown in Table 4, the mean monthly for building is 370,000 at 4.2 percent of the total cost, equipment is ₦466,700 per month at 5.3 percent, plant and machinery is ₦1,656,900 at 18.9 percent, truck is ₦1,730,800, at 19.7 percent and land takes ₦548,000 at 6.3 percent. The total cost is ₦8,764,150. The profit (revenue – cost of goods) is ₦11,355,017. Dividing this by the revenue gave 0.56 and multiplying it by 100% gives 56% profit. This means that for every ₦100 received there is 54.6% profit.

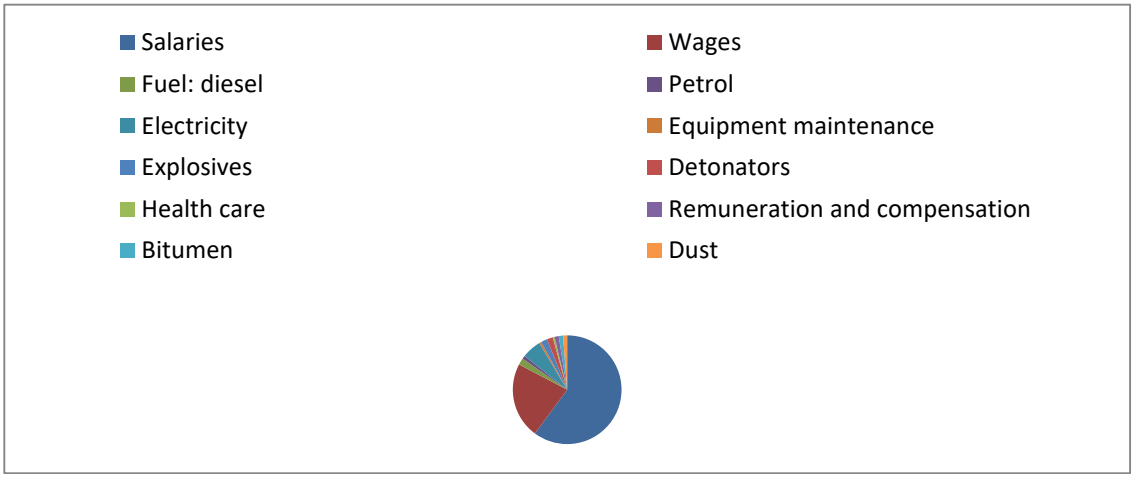

Figure 5. Pie chart presentation of granite/asphalt production variable cost

The salaries mean per month was recorded to be ₦ 2,400,000. It takes 27.4 percent of the total cost (Figure 5). Adopting wind consultants view, when the spending amount of any business falls between 15 and 30 percent of gross revenue on payroll, gross revenue on payroll, and such business is likely in solid standing. Also if in the service industry, the payroll costs could encompass more than 50 percent of your gross revenue.

In this work the payroll is taken to be the combination of the wages and salaries, the wages takes 10.3 percent of the total percentage of cost at a mean of ₦900,000, the total payroll is 33.7 percent.

The fuel is divided into two the diesel which takes 0.9 percent of the total cost and ₦80,700 per month, the petrol takes 0.4 percent at ₦38,700, electricity is at 2.6 percent at ₦230,000 at 2.6 percent, equipment maintenance takes 0.3 percent at ₦25,000 monthly, explosives is ₦75,000 monthly at 0.8 percent, bitumen being ordered is at 0.6 percent at ₦51,200 monthly, detonators is ₦71,600 monthly at 0.8 percent, health care takes ₦20,800 monthly at 0.2 percent, remuneration and compensation is ₦50, 000 monthly and takes 0.6 of the total cost, dust is ₦48,300 per month at 0.6 percent.
The fixed costs are: building, equipment, plant/machinery, trucks, and land (see Figure 4). The depreciation was calculated using formula given in Eq. 8

$$\text{Depreciation} = \frac{current\ wort}{expected\ life - current\ age} \times \frac{1}{12} \quad (8)$$

Estimating the Net Present Value (NPV)

$$\text{Annual Net Present Value} = \frac{\text{Annual cash Inflow – Annual cash outflow}}{(1+discount\ rate)^{time}} \quad (9)$$

At discount rate of 5% within one year;
The annual cash flow is ₦20,119,1167 and the annual cash outflow is ₦8,764,150, the discount rate is 5percent and the given time is 1 year (12 months), Using Eqs. (8-9) the calculated NPV is ₦10,814,300 which indicates positive value. According to Kumar (2016) a project with Positive Net Present Value indicates that the projected earnings generated by a project or investment in naira exceeds the incur costs. An investment with a positive NPV is highly profitable.

CONCLUSION

Asphalt production is an important contribution to the infrastructural development of Nigeria, it has contributed in terms of road construction, prevention of accident and it has helped government in so many areas. From the findings the following conclusion was drawn;
1. The price for the granite in 2018 was ₦2300, in 2019 was ₦2400 for asphalt the price for 2018 was ₦19,500 and in 2019 was ₦22,500.
2. The independent t-test conducted on granite production in the case study area shows that there is signification difference between the granite production revenue trend generated in year 2019 and 2019 at 5% degree of confidence.
3. The independent t-test conducted on asphalt production in the case study area shows that there is signification difference between the asphalt production revenue trend generated in year 2019 and 2019 at 5% degree of confidence.
4. The gross profit margin gives the fact that for each ₦100 a profit of 56.4% is made.

4. The net present value (NPV) gives the profit of ₦10,814,300 which gives the profit gained within the period of August 2018 to July 2019.
4. The production of asphalt is evaluated to be profitable in the study location.
However, the cost items involved in production includes: salary, wages, fuel, electricity, equipment maintenance, explosives, detonators, health care, remuneration and compensation, bitumen, dust, plant, machinery, building. Since the company is running on a profit within the period of study. The depreciation of this cost has not had any negative effect. The positivity of the Net Present Value is a chance for investors to invest in this kind of business which will also increase productivity, efficiency and a greater output.

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