Profitability of Granite Quarry Operation in Akure South Local Government Area of Ondo State, Nigeria

O.C. Alaba[1], Agbalajobi, S.A[2]

[1]Department of Mining Engineering, Federal University of Technology, Akure, Nigeria
[2]Department of Minerals and Petroleum Resources Engineering, Kwara State Polytechnic, Ilorin, Nigeria

E-mail: alab1m@yahoo.com, ayodele2kid@gmail.com

Abstract: The study assesses the economic profitability of granite aggregates production using Akure South Local Government Area of Ondo State, Nigeria as a case study. Three quarries were selected within the northern, southern and central part of Akure South Local Government Area and they were subjected to economic analysis based on their present operational status. Data was collected on performance characteristics of each of the quarries taking into consideration the cost implication of the basic cycles of operation. The data collected were then subjected to a pro-forma cash flow analyses for both short-run and long-run term investment. The result obtained shows that two quarries (Francisca Muinat Company (FMC) and Ebenezer Mining and Ceramic Company (EMCC)) out of the three quarries achieved returns on investment before the end of the first year of operation while the third company (Fountain Construction Company (FCC)) achieved return after the end of first year. The FMC recorded a profit of ₦570,380,000 while EMCC recorded a profit ₦563,210,000 and FCC recorded a profit of ₦369,539,100 within the first 8 years of operations. The study thereby concluded that as much as granite business is a capital intensive yet is a profitable business if is properly managed.

Keyword: Economic Analysis, Mining and Ceramic Company, Payback, Profit, Quarry Operation

1. Introduction

The production of granite aggregates involve creation of minimal breaks in the stone (blasting), removal of the stone using heavy machinery, securing of the stone on a vehicle for transport (hauling), and crushing the materials into various sizes (processing) [1]. Each of the basic cycle operations need to be subjected to economic

analysis. [2] Stated that a complete task of planning and operating a granite quarry involves at least three components which include a technical component, a narrowly focused economic component and a more broadly based economic component, including financial and business elements that influence quarry performance within industry at large.

The technical component involves granite quarry layout, equipment productivities, alternative production schedules, and quarry operating requirements [3]. These requirements include the explosive usage per year, the number of person required, and the fuel usage per machine per operating hour [4]. This component of a quarry plan will be unchanged whether project is economical or not as they basically referred to as the fixed input. The technical component defines all of the important elements required for the implementation of the quarry project. The narrowly focused economic component includes operating and capital costs to the technical schedules [5]. It analyses alternatives schedules and alternative equipment in economic terms e.g. the price per ton. It also build up and examines unit costs, such as the fuel cost per litre, annual fuel cost for the whole mine, and labour cost per person per year [6]. Often these narrowly focused economic evaluations concern just some component of the project for example, even if the mine itself is uneconomical, a valid economic analysis of the cheapest way to move waste can still be undertaken. Most mine evaluation is limited to technical work, coupled with this

narrowly focused economic phase. Based economic, financial, and business component aims to understand the degree of viability of a granite quarrying plan and how the plan fits within a wider corporate context.

The overall economic profitability of any quarry from a lender's point of view is mainly test through cash flow analysis. According to [7] the economic and financial parameters that can be used to build cash flow model are capital expenditure, variable operating cost, marginal cost, fixed operating cost, production rate and total cost. [8] Noted that the financial analysis of the quarrying plant shall appraise the financial projections; determine the economic production levels with a view to justifying the financial feasibility of the quarry. The principal indicators used in determining the economic capability of granite quarry are the payback period (PBP), the internal rate of return (IRR), the Net present value (NPV) and cost-benefit ratio (CBR) [7]. For this study, payback period was used to determine the profitability of the quarry project. By way of definition, the payback period represents the time period it takes a plant (quarry) to recoup its original capital outlay.

1.2 Granite Quarrying Operations

The successful and economical working of granite quarries depends upon an intelligent application of knowledge of the structure of the rock and its natural divisions in the mass, as well as upon improved methods, tools, and machinery for quarrying. The topographical location of the quarry and its relation to facilities for transportation are important factors that affect the productiveness and greatly modify the actual cost of operations in a given place. The process for granite quarrying operation is shown in Figure 1. The first step in quarrying is to gain access to the granite deposit. This is achieved by removing the layer of earth, vegetation, and rock unsuitable for product—collectively referred to as overburden—with heavy equipment and transferring to onsite storage for potential use in later reclamation of the site. After the face of the granite is exposed, the stone is removed from the quarry in benches, usually 8 to 12 feet square extending 20 feet or more using a variety of techniques suitable to the

geology and characteristics of the granite deposit. Quarrying operations typically include the drilling of holes on the bench, followed by blasting the holes using explosives. Once the holes on the bench are blasted, heavy equipment (excavator) will be used to remove the blasted rocks to inspection area (temporary storage) for grading and eventual haulaged from the site using dump trucks to crushing plant. Crushing plant will be used to reduce the blasting rock into smaller sizes (0-5 mm, 5-20 mm, 20 -40 mm) needed to use such as construction of bridges, tunnels, roads and building activities [8]

2. Material and Methods

2.1 Description of the Study Area

Three quarries were selected in Akure South Local Government Area of Ondo state, Nigeria for this study. The quarries are Francisca Muinat Company Quarry (FMC), Ebenezer mining and ceramic industry limited (EMCC) and Fountain Construction Company (FCC). FMC lies within latitude 07° 20' 26.1"N and 07° 20' 46.8"N and longitude 005° 10' 17.3"E and 005° 10' 35.7"E. It is situated at about 4km to Akure on Aaye-Ijare road. Lithological, this outcrop is made up of migmatite intruded by three petrological varieties of older granites. EMCC lies within latitude 07° 16' 45.5''N and longitude 005° 14' 48.9''E. It is situated about 5km along Akure – Owo road and FCC is situated at about 4km along Akure-Owo road, it lies within latitude 07° 16' 39.1"N and longitude 005° 14' 30.8"E Akure- north local government area of Ondo state. These quarries are for commercial purposes. Two of the quarry companies (FMC and FCC) are owned by the foreigners while the third quarry (EMCC) is owned by indigenous firm. Throughout the period of data collection for this study, all the quarries were on continuous production. Table 1 show the coordinates of the location of the study area.

2.2 Data Collection and Analysis

Data were collected by researcher personal assessment of accounting records of each of the quarries. This was supported by distribution and assessment of questionnaire to the head and assistance of each of quarry operation officers. The data collected are the quantity of granite rock

blasted per month, cost of drilling accessories used, cost of explosives used, and cost of maintenance of plant/equipment, cost of manpower, miscellaneous expenses and average selling prices per ton of granite aggregate. The data collected were used to determine the capital cost, production cost, total revenue, profit, total cash flow and payback period.

3. Results and Discussions

3.1 Result

Table 2 – 4 shows the cash flow for the period of eight [9] years annuity for Francisca Muinat Company (FMC), Ebenezer Mining and Ceramics Limited (EMCC) and Fountain Construction Company (FCC).

Table 1 Location of Study Area

| Study Area	Longitude	Latitude	Location
Francisca Muinat Company	$005^010'17.3"E$ $005^010'35.7"E$	$07^020'26.1"N$ $07^020'46.8"N$	Situated about 4km Aaye- Ijare road, Ondo State
Ebenezer Mining and Construction Limited	$005^014'48.9"E$ $005^014'61.2"E$	$07^016'45.5"N$ $07^016'58.5"N$	Situated at about 5km Akure – north local government area, along Akure-Owo road Ondo State.
Fountain Construction Company	$005^014'14.0"E$ $005^014'30.8"E$	$07^016'23.6"N$ $07^016'39.1"N$	Situated at about 4km Akure – north local government area along Akure-Owo road, Ondo State.
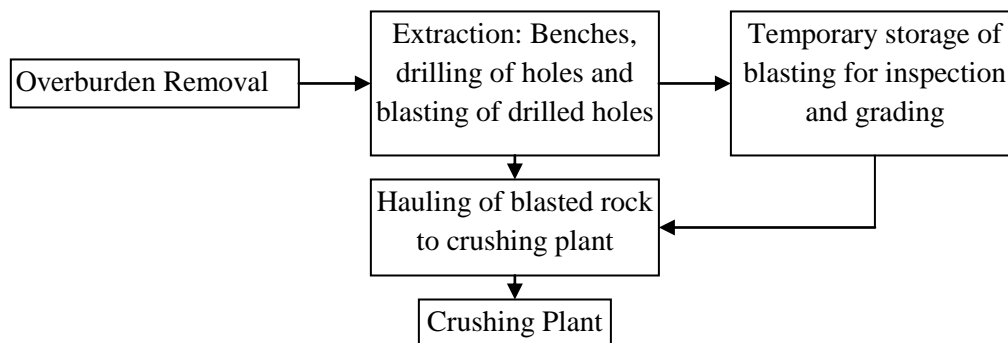
Figure 1: Process Flow Diagrams for Granite Quarrying Operations

Table 2 Cash Flow for the Period of 8 Years for Francisca Muinat Company (FMC)

End of year	1	2	3	4	5	6	7	8
Revenue (₦)	1,162,188,000.00	1,162,188,000.00	1,162,188,000.00	1,162,188,000.00	1,162,188,000.00	1,162,188,000.00	1,162,188,000.00	1,162,188,000.00
Fixed operating cost (₦)	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00
Variable operating cost (₦)	142,880,000.00	142,880,000.00	142,880,000.00	142,880,000.00	142,880,000.00	142,880,000.00	142,880,000.00	142,880,000.00
Tax on revenue (₦)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Operating margin (₦)	969,308,000.00	969,308,000.00	969,308,000.00	969,308,000.00	969,308,000.00	969,308,000.00	969,308,000.00	969,308,000.00
Capital expenditure (₦)	307,500,000	10,000,000	10,000,000	.	.	.	.	.
New capital allowance (₦)	4,417,468.75	145,751.35	145,751.35	.	.	.	.	.
Total capital allowance (₦)	4,417,468.75	4,563,220.10	4,708,971.45	4,708,971.45	4,708,971.45	4,708,971.45	4,708,971.45	4,708,971.45
Taxable income (₦)	964,890,531.30	964,744,779.90	964,599,028.60	964,599,028.60	964,599,028.60	964,599,028.60	964,599,028.60	964,599,028.60
Loss (₦)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tax on income (₦)	337,711,686.00	337,660,673.00	337,609,660.00	337,609,660.00	337,609,660.00	337,609,660.00	337,609,660.00	337,609,660
Working capital (₦)	16,073,333.33	16,073,333.33	16,073,333.33	16,073,333.33	16,073,333.33	16,073,333.33	16,073,333.33	16,073,333.33
Change in working capital (₦)	16,073,333.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash flow (₦)	645,734,666.70	621596314.00	621647327.00	631698340.00	631698340.00	631698340.00	631698340.00	631698340

Table 3 Cash Flow for the Period of 8 Years for Ebenezer Mining and Ceramic Limited (EMCC)

End of year	1	2	3	4	5	6	7	8
Revenue (₦)	507,000,000.00	507,000,000.00	507,000,000.00	507,000,000.00	507,000,000.00	507,000,000.00	507,000,000.00	507,000,000.00
Fixed operating cost (₦)	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00	50,000,000.00
Variable operating cost (₦)	129,710,000.00	129,710,000.00	129,710,000.00	129,710,000.00	129,710,000.00	129,710,000.00	129,710,000.00	129,710,000.00
Tax on revenue (₦)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Operating margin (₦)	327,290,000.00	327,290,000.00	327,290,000.00	327,290,000.00	327,290,000.00	327,290,000.00	327,290,000.00	327,290,000.00
Capital expenditure (₦)	403,500,000.00	15,000,000.00	15,000,000.00	-	-	-	-	-
New capital allowance (₦)	839,278.66	31,199.95	31,199.95	0.00	0.00	0.00	0.00	0.00
Total capital allowance (₦)	839,278.66	870,478.61	901,678.56	901,678.56	901,678.56	901,678.56	901,678.56	901,678.56
Taxable income (₦)	326,450,721.30	326,419,521.40	326,388,321.40	326,388,321.40	326,388,321.40	326,388,321.40	326,388,321.40	326,388,321.40
Loss (₦)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tax on income (₦)	114,257,752.50	114,246,832.50	114,235,912.50	114,235,912.50	114,235,912.50	114,235,912.50	114,235,912.50	114,235,912.50
Working capital (₦)	14,975,833.33	14,975,833.33	14,975,833.33	14,975,833.33	14,975,833.33	14,975,833.33	14,975,833.33	14,975,833.33
Change in working capital (₦)	14,975,833.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash flow (₦)	-91,185,833.30	198,032,247.50	198,043,167.50	213,054,087.50	213,054,087.50	213,054,087.50	213,054,087.50	213,054,087.50

Table 4 Cash Flow for the Period of 8 Years for Fountain Construction Company (FCC)

End of year	1	2	3	4	5	6	7	8
Revenue (₦)	908,544,100.00	908,544,100.00	908,544,100.00	908,544,100.00	908,544,100.00	908,544,100.00	908,544,100.00	908,544,100.00
Fixed operating cost (₦)	60,000,000.00	60,000,000.00	60,000,000.00	60,000,000.00	60,000,000.00	60,000,000.00	60,000,000.00	60,000,000.00
Variable operating cost (₦)	73,039,100.00	73,039,100.00	73,039,100.00	73,039,100.00	73,039,100.00	73,039,100.00	73,039,100.00	73,039,100.00
Tax on revenue (₦)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Operating margin (₦)	775,505,000.00	775,505,000.00	775,505,000.00	775,505,000.00	775,505,000.00	775,505,000.00	775,505,000.00	775,505,000.00
Capital expenditure (₦)	256,500,000.00	20,000,000.00	20,000,000.00	-	-	-	-	-
New capital allowance (₦)	2,080,798.25	163,572.42	163,572.42	0.00	0.00	0.00	0.00	0.00
Total capital allowance (₦)	2,080,798.25	2,244,370.67	2,407,943.09	2,407,943.09	2,407,943.09	2,407,943.09	2,407,943.09	2,407,943.09
Taxable income (₦)	773,424,201.80	773,260,629.30	773,097,056.90	773,097,056.90	773,097,056.90	773,097,056.90	773,097,056.90	773,097,056.90
Loss (₦)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tax on income (₦)	270,698,470.60	270,641,220.30	270,583,969.90	270,583,969.90	270,583,969.90	270,583,969.90	270,583,969.90	270,583,969.90
Working capital (₦)	11,086,591.67	11,086,591.67	11,086,591.67	11,086,591.67	11,086,591.67	11,086,591.67	11,086,591.67	11,086,591.67
Change in working capital (₦)	11,086,591.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash flow (₦)	507,918,408.30	484,806,529.40	484,863,779.70	504,921,030.10	504,921,030.10	504,921,030.10	504,921,030.10	504,921,030.10

3.2 Discussion

Figure 2 shows the cash flow against the number of years for Francisca Muinat Company (FMC). From the figure, it was deduced that the company started paying back after the first eight month which is concise with the gestation period of eight months, which means that FMC is economically viable and profitable organization.
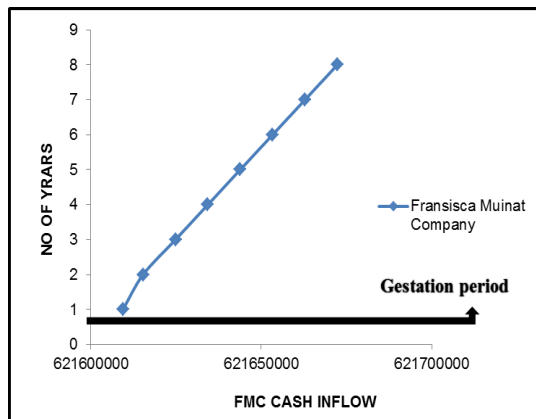
Figure 3 shows the cash flow against the number of years for Ebenezer Mining and Ceramics Limited (EMCC). From the figure, it was deduced that the company started paying back after the first year and seventh month which is a few months after the gestation period. This shows that the company is economically viable and profitable organization.
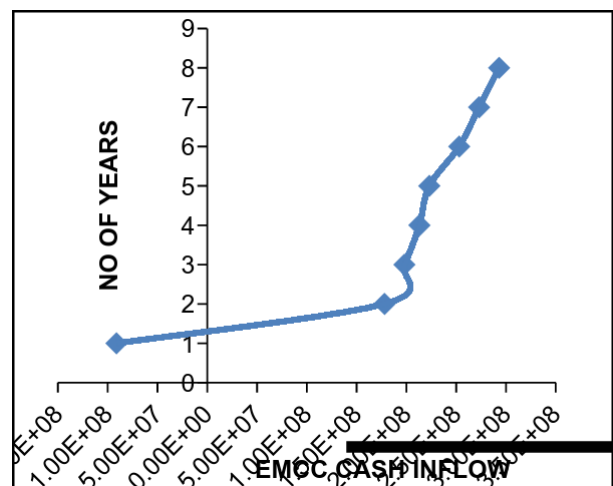

Figure 2: Cash flow for Francisca Muinat Company (FMC)

Figure 3: Cash flow for Ebenezer Mining and Ceramics Limited (EMCC)

Figure 4 shows the cash flow against the number of years for Fountain Construction Company (FCC). From the figure, it was deduced that the company started paying back after the first six month before the gestation period of eight months which means that the company is economically viable and highly profitable organization**.**
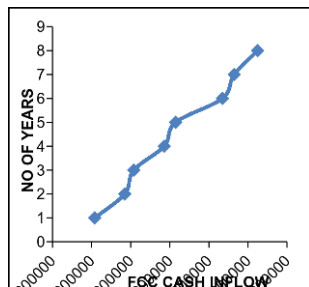

Figure 4: Cash flow for Fountain Construction Company (FCC).

Figure 5 shows the comparison of cash flow of three companies. It was deduced that from the figure that two companies (FMC and FCC) started payback period before the end of first year while the third company (EMCC) started its own payback period after the first year and some months. The chart shows the movement of the flow chart from the negative region to the positive region as shown by the gestation period line AB. This shows how highly economical and financially viable granite deposit is and how profitability it is to embark on such project.
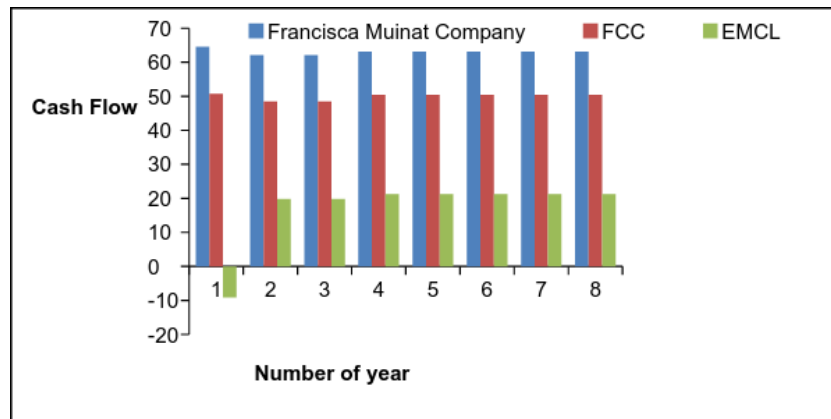

Figure 5: Cash Flow Comparison against Companies Performance

4. Conclusion

The economic profitability of quarry industry in Ondo state was carried out. This is as a result of usefulness of the quarry products in construction industry within and outside the state. The analyse shows that two of the selected quarries (FMC and EMCL) reached their payback periods within the recommended gestation period of eighty months for quarry industry while third quarry reach its payback period a few months after the recommended gestation period. The study therefore concluded that despite that quarry operation is a capital intensive yet is economic viable and profitable business in Ondo state. The study recommended that before anybody invests on quarry operation, the following technical factors must be considered holes diameter, burden and spacing, bench height, rock structure, type of handling and crushing equipment and type of explosives used and the blast design since these determine the revenue and profit of quarry organization.

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