Investment Analysis For The Establishment Of Spheroidal Graphite Iron Plant In Nigeria

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Abstract: An investment analysis for the establishment of Spheroidal Graphite Iron (SGI) plant in Nigeria was conducted to assess the viability of setting up a plant. Spheroidal Graphite Iron outperforms grey cast iron due to possession of the following attributes: improved strength, ductility toughness and hot work ability, with grades guarantying more than 18% elongation or high strength, with tensile strength exceeding 825 MPA . The analysis was done for a manufacturing plant with an installed capacity of 300 tonnes of SGI per annum. As part of the methodology, a market analysis, the required materials, equipment, and human resource requirements are presented. The financial implication, financial and breakeven analyses were carried out. The market analysis substantiates a ready market for SGI and the required total capital investment for the plant is approximately, ₦38 million. The estimated annual profit is approximately ₦ 29 million. The financial analysis shows that the investment is a profitable venture with a good profitability ratio and rate of return. The payback period for the venture is less than 2 years.

Index Terms: investment, profitability, Spheroidal graphite iron, Analysis, Plant.

1 INTRODUCTION

Spheroidal graphite iron (SGI) consists of graphite spheroids in a matrix of ferrite, pearlite or both, the graphite spheroids provide some much improved mechanical advantages compared to the graphite flakes in grey cast iron. SGI is similar to grey cast iron in having a low melting point, good fluidity, castability, excellent machine ability and wear resistance. However compared to grey cast iron it has improved strength, ductility toughness and hot work ability, with grades guarantying more than 18% elongation or high strength, with tensile strength exceeding 825 MPA (Marston, 1990). Spheroidal graphite iron is also known as nodular cast iron, or spherulitic graphite cast iron (Degarmo, et al., 2003). The properties of SDI can be tailored for applications requiring high toughness, corrosion resistance and high tensile strength (Labrecque and Gagné, 1998). Ductile iron is one of the most important engineering materials, in view of its excellent castability, significantly better mechanical properties and low cost (Imasogie, 1994) and it represents the fastest growing segment of the iron market (Urbat, 2003). Attaining the full potential of spheroidal ductile iron involves superior metallurgical process control, as well as the highest levels of skill in melting, spheroidizing and inoculation in order to obtain the desired mechanical and microstructural properties. Tool bar to modify the header or footer on subsequent pages.The formation of graphite during solidification cause an internal expansion of spheroidal graphite as it solidified with feeder that are much smaller than those of malleable iron and (William, 1981).

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Castings as products of foundries, impacts every facet of the economy. They are found in various sectors, such as textile, housing, construction and other sectors of the economy hence the importance of SGI in meeting these requirements is pervasive. An industrialized country is marked out by the level of industrial activities in manufacturing services, and consumer products etc. millions of castable industrial parts that could be successfully cast in Nigeria but for cost, technology and absence of cottage foundries are imported. Nigeria steel /casting imports 1993-1997, was 277,000 tons value at 10.7 billion Naira, correspondingly our crude steel production decreases from 36,000 tons in 1993 to zero tons by 1998 (IISI,1999). Nigeria like Malaysia and Indonesia are considered to be 'developing economy'. Malaysia export items consist of 75% local manufactured electronic components, 10.6% crude petroleum, 5.9% natural rubber and 3% natural gas (Allison, 1995). Indonesia export items consist of 26% crude petroleum, 12.5% natural gas and 61-5% manufactures goods (Allison.1995). However, Nigeria export consists of 95% crude oil and natural gas while the balance of 6% consists of the mix of essentially raw materials with virtually no local volume added (Inuwa, 2002) Spherical graphite iron (SGI) is a high carbon ferrous material with graphite in the spheroidal form achieved with a small amount of magnesium and therefore the name derived. To make SGI, mild steel scrap, Ferro-Silicon, coke, etc are melted in induction furnace. Once the melt is ready it is inoculated with calculated small addition of magnesium or chromium available in Ferro-blends. The molten metal is then poured into moulds, cooled and fettled. The total carbon remains as spheroid in as-cast condition but if required, it may further be annealed to achieve the desired properties. In a market survey conducted by Ajaokuta steel company limited Foundry and Pattern shop, which covered the locally manufacture castings produces from over fifty foundries and their cost and price range, it also covered imported casting of spheroidal graphite iron and their landed prices in Nigeria. It was on this basis that this research was conducted and this showed that the manufacturing of SGI in Nigeria is a worthwhile investment that and will solve the problem of importation to our local industries at affordable price.

2.0 BASIC AND PRESUMPTIONS

- Prices of machinery and equipment as included is the profile are of particular made will change with the make and model of actual machine procured.

- Prices of raw material and others consumables are those ruling at time of preparation of this paper profile.
- 5% irrecoverable melting loss has been considered. Rejection of runners, spurs and risers will be recycled.
- Pay back period of 3 years had been considered after $1^1/2$ years of moratorium period. (moratorium period means temporary shopping of activities)
- The scheme is based on single shift of 8 hours at 75% efficiency assuming 300 working days in a year.
- It is presumed that capacity utilization will be 70% in the 1st year, 80% in the 2nd year and 85% in the subsequent years.
- The salaries and wages of workers are the prevailing rules in the Nigeria economy particularly to the consolidated salary structure (contiss).
- The interest rate for fixed and working capital has been assumed at 21% on an average financed by financial institution.
- Margin money required is minimum 30% of the projected investment.

Implementation Schedule

No.	Activity period	Months.
1	Selection of site	01 - 03
2	Preparation of project site/construction	01 -17
3	Provisional registrations	01 - 06
4	Financial arrangement	01 - 06
5	Procurement of machinery	07 - 15
6	Installation and electrification	07 -18

The above mentioned schedule may be considered as guideline only. It can best be implemented in a period of 15 to 18 months by performing some common activities simultaneously with proper and systematic planning (Everett et al; 2002)

Estimation

Financial Aspect

A. Fixed capital

(i) Land and Building	Cost (N,000.00)
(a) Land	5,000
(b) Building Office/ Laboratories	7,200
Factory shop floor	3,300
Total	**15,500**

Machinery and equipment

(ii) Machinery and equipment	Qty	Unit cost (N, 000.00)	Cost (N, 000.00)
1.2000 kg medium frequency Induction melting Furnace.	1	1,500	1,500
2. Water Softening Plant	1	100	100
3. Plate Type Heat Exchanger	1	100	100
4. Immersion Pyrometer	1	50	50
5. Air Compressor (7.5 HP)	1	200	200
6. EOT Crane (1.5 Ton Capacity)	1	130	130
7. Heat Treatment Furnace	1	250	250
8. Core and mould drying oven oil fired	1	230	230
9. Fettling and Cutting Tools (Mechanized)	2	120	240
10. Chemical laboratory equipment for routine testing.		800	800
11. One overhead tank, underground Water tank pipelines, with cooling towers	1	200	200
12 Transformer, cables and cost of Power connection	1	1,200	1,200
13. D.G. set (60 KVA)	1	225	225
14. Grinders (flexible shaft)	2	60	120
15. Grinders (swing frame type)	2	60	120
16. Platform Weighing Scale	1	70	70
17.Hand operated Moulding machine with squeezing arm, Plunger and pressure plate	1	220	220
18. Sand Mixer. 250 kg batch with motor and Accessories	1	250	250
19. Sieving Machine with sieves	1	180	180
20, Material Handling Equipment	2	50	100
21. Electrification and installation of machinery and equipment; of the cost charge	1	900	900
22. Cost of Moulds and Foundry Tools	1	120	120
23. Patterns	1	100	100
24. Cost of Office Equipment	1	850	850
25. Pre-operative Expenses		200	200
Total			**8,455**

B. Working Capital

(i) Perxonnel		Salary	Salary
Type of personnel	No.	(N)	(N)
1. Metallurgist (1)	1	124,710.42	1,496,525
2. Smelter	1	37,456.75	449,481
3. Foreman	1	60,356.83	724,282
4. Chemist	1	124,710.42	1,496,525
5. Clerk/Typist	1	37,456.75	449,481
6. Store-Keeper	1	37,456.75	449,481
7. Furnace Operator	2	53962.33	647,548
8.Skilled Workers	4	122,610.67	1,471,328
9. Unskilled Workers	2	50,233,83	602,806
10. Labourer	3	75,350.75	904,209
11. Security Men	4	100,467.66	1,205,611
Total			9,897,277
Perquisites @ 15%			1,484,592
Total			**11,381,868**

(ii) Raw Materials (Indigenous)	Qty(MT)	Cost (N,000.00)	Cost (N,000.00)
1. Mild Steel scrap	20.0	80	1,600
2. Ferro Alloys [Fe-Si, Fe-Mg etc.]	0.5	150	75
3. Refractory such as hot top and, Crucible linings and Ramming Mass (Magnesium oxide) etc.	4.0	35	140
4. Molding sand, binder and other materials	1.0	30	30
5. Packaging materials	1.0	20	20
Total			**1,265**

(iii) Utilities and Contingent Expenses	Unit/Litres	Unit cost(N)	Cost (N,000.00)
1. Power (Diesel)	3,000	160	480
2. Water Charges (Lump sum)			10
3. Furnace Oil	1,000	80	80
4. Advertisement and publicity			100
5. Postage			5
6. Telephone			20
7. Consumable stores like chemicals, oil for hydraulic power pack grinding wheel etc.			100
8. Repair and maintenance			100
9. Insurance			100
10. Miscellaneous			50
Total			**1,045**

(iv) Total Recurring Expenses	N
Salary and Wages	11,381,868
Raw Materials	1,265.000
Utilities and other Contingent Expenses	1,045,000
Total	**13,691868**

C. Total Capital Investment

Total Working Capital (for 12 months)	N
(I) Land and Building	15,500,000
(ii) Machinery and Equipment	8,455,000
(iii) Working Capital	13,691868
Total	**37,646,868**

FINANCIAL ANALYSIS

I. Cost of Production (per annum)	Percentage	N
a. Total recurring expenditure		37,646,868
b. Depreciation on Building	5%	525,000
c. Depreciation on machinery and equipment	10%	593,500
d. Depreciation on Furnaces	30%	450,000
e. Depreciation on Moulds Tools	30%	36,000
f. Depreciation on Pattern	30%	30,000
g. Depreciation on office equipment	20%	160,000
h. Interest on total investment	18%	6,776,437
Total		**46,217,805**

(2)Total Sales (per annum)	Quantity (MT)	Cost per MT (N)	Total Sales (N)
	300	250,000	**75,000,000**

(3) Profitability (per annum)	Annual Sales (N)	Cost of production (N)	Net Profit (N)
	75,000,000	46,217,805	**28,782,195**

Fixed Cost (Per annum)	N
Total depreciation	1,794,500
Interest on total investment	6,776,437
Salary and wages	11,381,868
Utilities and contingencies (40%)	418000
Miscellaneous	50,000
Total	**20,420,805**

Variable Cost (Per Annum)	N
Raw materials	1,265,000
Utilities and contingencies (60%)	627,000
Miscellaneous	50,000
Total	**1,942,000**

Profitability Ratios and Break Even Analysis

Profitability ratios are designed to reflect the profitability of the enterprise; those considered are profit ratio and rate of return. The breakeven analysis reflects the level at which the enterprise begins to make some profit or loss while the payback period is the estimated time for the revenues to recover the initial investment, a 2-year period of moratorium is assumed for this study. The profit ratio, rate of return and break-even-point expressions used are as given by Khana (2006).

Profit Ratio

= 38.38%

Rate of Return

28,782,195/(37,646,868)

= 76.45%

Break Even Point

= 41.50%

Payback Period =

=

= 1.4 years.

CONCLUSION

A total capital investment of approximately ₦ 42.5 million Naira, will be required for setting up this furnace manufacturing plant and a total number of 17 skilled and unskilled personnel will be required to run the establishment. At a proposed selling price of ₦650,000 per unit, annual estimated profit is approximately ₦27.1 million. The profit ratio of 34.8%, rate of return of 64.1% and break-even point of 32 units of the furnace with a payback period of less than 2 years has shown that the investment is a profitable venture. This investment will not only generate income for local investors but will also create employment for different categories of professionals. Although the projects looks a little expensive, but the payback period showed that the amount invested could be recouped after three years. Finally looking at the characteristics and importance of S.G Iron in the Auto mobile industries and other Engineering applications, it is therefore worthy to embark on such viable project that will provide raw materials, employment generation and will further contribute to national economy and growth.

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