

## Focusing Foundry Engineering for Economic Recovery: A Case Study of the Ajaokuta Foundry Shop and Making Shop

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### Abstract

The Foundry and Pattern Making Shop of the Ajaokuta Steel Company Limited have in the past and present contributed to national economy. It has also made available spare parts for internal and external needs. In this presentation, the shop is discussed in order to highlight the derivable benefits and its contributions. The actualization of the shop could only be achieved if the shop is refocused and repositioned with a view to solving the problems of spare parts production in other sectors of the nation's economy like in the manufacturing, housing, agriculture, constructions, refinery, power and energy for economic recovery etc. Foundry as a sub-sector was examined as a catalyst/booster that fully blows industrial activity. Suggestions and recommendations were made with a view to refocusing the shop for economy recovery.

**Keywords** Refocusing; Foundry; Engineering; Recovery and Economic

### Introduction

The Ajaokuta Foundry is nominally a 7,000 tonnes capacity jobbing Foundry envisaged to be a captive unit to the Ajaokuta Steel Company Limited for the production of both ferrous and Non-ferrous spare parts for the Steel Plant and to external customers. The Ajaokuta Steel Plant is designed to source 78% of its spare parts requirement in-house in the form of machine components and spare of medium to large unit weights which was occasioned by its peculiar geographical location far from urban areas. Most integrated Steel Plants the world over especially in the third world countries are from conception designed to be self-sustaining in meeting their primary spare parts needs to minimize costly down-times and loss of production hours, in the same vain, the Ajaokuta Foundry is part of an integrated network of ancillary service Shops Forge and Fabrication, Machine and Tools Shop, the Power Equipment Repair Shops, etc. meant primarily to be captive units to the plant [1]. Being a Jobbing outfit, the Ajaokuta Foundry is not capable of mass production of items or replicates such items in large numbers as would be the case for a precision Die-Cast Foundry. As the vessels and furnaces and other handling facilities are large varying from 1tonne to 10 tonnes capacities, only single unit items could be produced in an intermittent manner [2]. This pressurizes a batch type melting cycle of 2 to 2½ h each closely followed by another 30 to 45 min casting schedule, knocking-out and fettling operation of 1h to 2 h depending on size of casting and another period of 2 to 18 h for heat treatment depending on the composition of each product mix. Generally speaking, the foundry encompasses 16-21 process steps for each category of castings produced from casting design to pattern making to materials/alloy selection to sand preparation to moulding to melting to casting to fettling and finally to heat treatment and quality control processes that involves all the production line in Foundry operations [1-3].

Each of these process steps requires the skill and dexterity of the supervisors and is energy sapping independent operations. The intrinsic nature of the operations, therefore, requires round the clock quality control and preparation of charge calculations to meet the challenging quality demand of production and to finally use the SPECTRO Analytical Instrument to determine the chemical compositions of cast products as a confirmation of charge calculations prepared prior to melting and casting operations.

### Production Geared Towards the Utilization of the Facilities in the Foundry Shop of the Ajaokuta Steel

As already mentioned, the Foundry shop of Ajaokuta was designed from inception to meet the spare parts requirement of the Steel Plant, utilizing its two shift production system to meet the 7,000-tonnes capacity. It must be emphasized here that this capacity utilization depends on number of indices of production.

- (i) The range of sizes/unit weight of castings
- (ii) The complexity of shapes involved.
- (iii) The effective utilization of machine spares machine hours
- (iv) The availability of utilities (compressed air, power, water, steam, etc.) at the pressure and constancy required.
- (v) Industrial harmony and a disciplined work force.

Of the above indices, achieving a reasonable measure of capacity utilization for a large foundry with a jobbing orientation like ours depends mostly on the categories of unit weight castings that are cumulatively handled within a giving period [3]. For example, if we are fortunate to have job orders of castings ranging from 2 to 5 tonnes unit weight forming 90% of the total yearly orders of the foundry, the capacity utilization of the foundry is more easily enhanced than if job-orders are for items of 100 kg forming 20% of the yearly requirement of castings.

It is for this reason, that projections for the future are usually expressed in unit weight of casting than in machine hours or man hours available. The design capacity can easily be stretched also if provision spare made for a third shift and this scenario is necessary when the Ajaokuta Steel Plant fully takes off, whereby the two shifts already earmarked would be utilized exclusively for meeting the needs of the Steel plant, while the third shift would be geared towards meeting the orders of external agencies, strictly speaking the Ajaokuta Foundry has melting capacity of about 30,000 tonnes of both ferrous and Non-ferrous composition annually which could be channelled into castings of sundry shapes and sizes, provided enough moulds could be made available at the same frequency of melting [4].

## Prospects of Ajaokuta Foundry in Economy Recovery

### (a) Enhanced utilization of ajaokuta steel foundry

From the castings demand survey report of TECO LTD of 1991 made on the Ajaokuta Foundry shop, the survey report made by TECO as received by the shop indicated that about 1,314 companies in Nigeria demand for spare parts and Foundry items from the shop. The cursory picture showed a demand as follows:

(a) The Agricultural Sector-16,000 tonnes of casting annually.

(b) The cement manufacturing sector-24,000 tonnes of grinding media, Mill liner plates, and Diagram plates

(c) National Electric Power Authority (NEPA)-18,000 tonnes of Steel structures and spare parts (now known as PHCN).

(d) The Nigerian oil Sector required: Piles-620 tonnes, Deck steel-150 tonnes, Hollow Sections-50 tonnes, Plates and Bars-50 tonnes

### (b) Foundry as a catalyst/booster to industrial development

An industrialized country is marked out by the level of industrial activities it involved in the following sectors (a) Manufacturing, (b) Services, (c) Housing, (d) Agriculture and (e) Energy. (f) Communication etc. There will be industries that produce the wide varieties of domestic needs, medicines, consumer products etc. There will be industries that provide the most needed services such as water supply and distribution, electric power, communications facilities etc. which will assist in contributing to economy recovery.

There will be an agriculture that is mechanized and thus efficient. In doing this, the primary-industry sub-sector will be actively and vibrantly engaged in mining and extracting basic metals, processing ores and other industrial raw materials. The secondary industries such as foundries, machine shops, forge and fabrication shop etc. would exist at small-scale and medium-scale capacities [5]. The tertiary industries will be mass-producing in their specialized areas.

When all these come to be, the foundry plays the vital role of servicing the primary industries with spares and replacement parts, supporting its counterparts at the secondary industry level with "raw-materials" for specialized operation [5,6]. Similarly, it supports the tertiary industries by supplying input components, and spare/replacement parts.

It is quite interesting watching the mixed dependence of these three tiers of industries. The foundry requires the third tier to come into existence, and the first tier to remain in operation, but these tiers correspondingly require the Ajaokuta foundry to supply the

mechanical components required to keep their machines in operation and to manufacture new machines [7].

The Federal Ministry of Science and Technology captured this symbiosis accurately when, in the 1980's, it set out to promote the establishment of such secondary industries which were rightly code-named "Engineering Infrastructure" for Industrialization [8,9]. The contributions of the Ajaokuta Foundry products in economy recovery of the Nation, these are further emphasized in these sectors for growth and to reduce the challenges and their dependence on importation of machines, equipment and spare parts [10].

### Agricultural sector

Machine components of agric-machines: (tractors, harvesters, tillers etc.) among which are, shafts, pulleys, flywheels, couplings, rollers, pump & compressor, impellers pump casings, parts of mowers, ploughs and cultivating equipment, corn mills parts and plates, oil expellers parts, walter pumps and hand pump.

### Petroleum industry

Machine components and mechanical parts, including: Valves, pipes fittings, bearings and bearing housings, cast-iron couplings, heat exchanger sheets, conveyor components etc.

### Power industry

Machine components and mechanical parts, including: Pump and compressor, impellers, pump casings, ducting, power distribution structural parts, and furnace and boiler parts etc.

### Automobile industry

Machine components and mechanical parts including: Engine blocks, cylinder heads, brake discs, brake drums, manifolds, axles, gear boxes, crank shafts, pinions, rollers, steering knuckles, callipers, rock arm carburettor bodies, connecting rods, piston, fuel pumps, intake manifold, master cylinder body, transmission housing, Valve rocker arm, crank cases, Engine block, cylinder heads, etc.

### Defence industries

Machine components and mechanical parts including: Munitions shells for grenades and land mines rocket war-heads components for tanks and artillery bodies, etc.

### Electrical equipment

Motor frames heads, Refrigerator compressor part for power lines, cast resistor, Electric base, change over switch bodies, gear switch bodies, Gland (dating) etc.

### Ceramic and refractory industry

Extrusion press dies, impellers, Ceramic press arm, stone polishing spirals, dies for tiles and bricks, etc.

Refocusing and repositioning the Ajaokuta Foundry will contribute immensely to economy recovery of the nation and will continue to make these sectors to thrive, as they ought to do in any solid nation, these sectors must be adequately serviced by the right number and quality of products from the Foundry [11]. If the Ajaokuta Foundry is encouraged to produce the needed machine components and mechanical parts indigenously/locally, when that becomes

possible, our local factories will become more efficient, Power Holding Cooperation of Nigeria (PHCN) operations will improve in an authentic and sustainable manner; then many linkage industries will all be in active business, revenue will be generated, poverty will be eradicated in our society, employment will be galore, all services will improve in their delivery and everybody will be happy [10-12]. This will mean that the Nigerian people will have cause not to panic.

The obvious inadequacy of the Foundry industry in Nigeria explains the prohibitive costs of consumer products, low capacity availability and low efficiency. India, although a large continent, has as at 1998, over 9,000 registered foundries. The Far-East countries or the so called "Asian Tigers" are thriving because they have thriving support Foundries.

Only so shall we be able to support irrigation and agriculture, grass-root development; food processing, water supply and small-scale industries for consumer items for large group and also take a step further to develop our rural areas and to discourage the drift from the villages to cities [13].

### Suggestions/Recommendations

However, for the Ajaokuta Foundry to produce and meet the global demand for economy recovery, and also reduce dependence on importation of goods and services from foreign countries the government, the stakeholders and the management of the Ajaokuta Steel Company Limited must refocus and reposition the Foundry:

Federal Government should reactive and rehabilitate the Ajaokuta Steel Company Limited with reference to the Foundry Shop.

Government should encourage indigenous production of spare parts, machines and make a legal pronouncement that 30-40% of our spare parts production must have local content, this will further encourage our foundry men to step up their productions to meet our demands.

The management of the shop should consider the provision of flask less moulding facilities for the production of grinding media in large tonnages (high pressure moulding facilities) which will not require the use of mould boxes.

The management should provide medium-size programmable heat-treatment furnaces.

The management should consider the provision of pressure Die-Casting facilities and Investment Casting.

The management should consider the provision of FURAN-based system for the production of photo-finish castings requiring no machining.

The procedure for sand processing in the Foundry should be allowed for processing of high quality moulding sand and at the same time sell to other foundries.

The Government should encourage those that are interested in setting up foundry plant by making the enabling environment conducive and cost affordable.

Nigerian Bank of industry and Commercial Banks should grant loans and access to funding at concessional discount rates from Technology and Industrial banks [14].

Know-how acquisition: The trade schools and the tertiary educational institutions must mass produce Foundry men, Technicians, Metallurgists and Engineers.

Government should guarantee market that will protect the foundry industries from severe and unfair competition with imports from Europe, America, and Far-East, India.

Protective tariff on imported mechanical parts (only those that cannot be produced locally should be imported) etc.

A psychological, mental and spiritual re-orientation of Nigerians generally and Nigerian leaders in particular with the gospel of sincerity in implementation of government official policies; on the virtue of national pride and patriotism, and the recognition of the limited powers of individualized wealth in the midst of a depressed people [15, 16].

### Conclusion

The Ajaokuta Foundry has contributed immensely to nation's economy as it has met the demand of the steel plant and other external agencies [17]. Ajaokuta Foundry has also contributed to the financial growth of the steel plant as a lot of revenue had been generated from this shop. The Ajaokuta Foundry shop has been serving as a key contributor to the economic development of Nigeria [18]. With this vibrant foundry shop, the production, manufacturing and serviced oriented industries, Nigeria can be transformed into a highly industrialized nation in the world as we refocusing and repositioning for economy recovery after the experience from the financial crisis at the global, employment could also be generated for our teeming Nigerians who are willing to contribute their quota to the growth of our economy [19].

In conclusion, Ajaokuta Foundry shop serves as economy trigger, create job opportunity to our youth, enhancing the technological skill of personnel who are engaged in foundry activities making them independent in later time in life, provision of spare parts, foundry needs to external agencies, therefore reducing their independence on importation of these spares and a lot of revenue could be generated from this foundry operations/activities.

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