Casting Technology And Developments. "Nigeria As A Case Study"

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ABSTRACT: Nigeria's economy is dependent largely upon importation of spare parts and machine component for such vital sectors of the economy *as ship building, railways, agriculture,* cement industry, food processing, power generation, etc. in this paper, factors that are affecting the development of foundry technology in Nigeria were highlighted, such as training of foundry personnel; investment in foundry technology development; Government policies towards foundry industry; Development of foundry raw materials; Level of research and development and the automotive industry. Finally, recommendations constituting the way forward in ensuring a better casting technology and development in -Nigeria were made.

Keywords*: casting, technology, development, foundry, railways, government and spare parts.*

INTRODUCTION

The development of casting technology should be a strategic concern to planners of rapid industrialization of any nation. Major components of machine tools, power plants, industrial machinery and equipment, automotive, agricultural and textile industries, etc are products of the foundry. Hardly can you think of any major machine or equipment which has no components that have been cast in a foundry. One can therefore rightly say that the acquisition of foundry technology is basic to economic development and self reliance. In Nigeria, little has been paid to the development of the casting industry for too long. This is one of the reasons for our over dependence on imported spare parts and machine components for such vital sectors of the economy as ship-building, railways, agriculture, cement industry, food processing, power generations, etc. it is an open secret that the few public foundries which are in existence such as the Nigerian Machine Tools, Ajaokuta Steel Company. *Aladja Steel Company,* and *Nigeria Railways* Corporation, etc. are operating below-optimal levels, if they operate at all, because of lack of adequate working capital, trained manpower, stable power supply and infrastructure facilities. Some of these public corporations and their foundries have been closed down for over one year.

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On the other hand, the privately owned foundries which are better managed are few and they are small jobbing foundries. This is understandable as many private investors cannot afford the investment required to set up large scale foundries, Put together, their output falls far short of national demand for foundry products both in quantity and variety. Consequently, the shortfall is met through imports of casting at very high foreign costs of the nation. In this paper therefore, the following items are being considered as the major factors that are affecting the development of casting technology in Nigeria.

- Training of foundry personnel
- Investment in casting technology development
- Government policies towards foundry industry
- Development of casting raw materials
- Level of research and development

TRAINING OF FOUNDRY PERSONNEL

"In. 1986, the National Committee on Foundry Development identified the following bottlenecks in foundry industry. Absence of qualified pattern makers in Nigeria. This means that the expertise for translating casting requirement into drawings and patterns is virtually absent. Inadequacy of trained, experienced and skilled labour force. This is to say that people with basic technological knowledge and know-how in foundry technology are few and inadequate. Poor commercial management. The foundry industry, like other enterprises requires adequate orientation and the right attitude towards profit making, financial controls and strategic planning. Foundries must be run-as money-making enterprises and casting must be priced competitively. Absence of strong local institutes which can provide solutions to industrial problems in such vital areas as quality control, new product development and production techniques. Inadequacy of educational and training facilities for foundry engineers, technicians and craftsmen. Twelve years after the National Committee on Foundry Development completed its assignment, we are not aware of any significant improvement in the training of personnel for the foundry industry. For a foundry to be viable, three categories of technical manpower are needed, namely:

- Foundry craftsmen
- Foundry technicians
- Foundry engineers

INVESTMENT IN THE DEVELOPMENT OF CASTING TECHNOLOGY

Modern foundries are designed **and** built to make money at least on the long run. Therefore an investor requires funds and experienced partners to:

- Design a suitable foundry to meet demands of a particular market i.e.
- to match the foundry with the casting;
- Supply the right type of foundry equipment;
- Build, install and commission the foundry machinery and equipment;
- Run and manage the production process;
- Train the operatives

To make an investment profitable, you need a foundry which is optimally equipped for a specific product or range of products. You will have to apply the best technology for that product with an optimum rate of automation. This translates to the so-called "Product Dedicated Foundry". In most cases, product dedicated foundries focus on the global market. Therefore, their products need to be of the highest quality at the lowest price. To achieve this scenario, entrepreneurs must invest in high technology with capacity for large volume production in order to take advantage of the economy or scale. For the local market, the most common situation is the jobbing foundry which most often produces one-off casting or few castings of same type. This implies that many patterns will have to be made. A well equipped pattern shop is necessary. Depending on the market need and the type of casting, the design engineer could decide for a foundry with cupola, crucible, and rotary or electric induction furnace [7].

GOVERNMENT POLICIES TOWARDS CASTING INDUSTRY

The National Policy Objectives on foundry development are-very laudable.
They include:

- The promotion of growth and spread of foundries-and *allied* metal forming industries in the country;
- The promotion of metal forging and spare parts manufacturing industries;
- The development and growth of machine tools industries;
- The development of indigenous engineering capabilities for the design and manufacture of plants and machinery

It is necessary to put implementation strategies to work to achieve the objectives set out above. Furthermore, all disincentives for the establishment of foundries should be eliminated. The Foundry Association of Nigeria has made the following suggestions, which when implemented will create a better environment for foundry development [3].

- A ban should be placed on the export of scrap metals;
- Standards should be established for all foundry materials and castings;
- Local entrepreneurs should be encouraged to produce spare parts and machine components;
- Educational curricula should be established at all levels or our institutions for the training of foundry manpower;
- Craftsmen foundry training courses should be funded by government;
- A loan scheme should be organized to finance foundry Projects;
- Government should reduce tariff and import duty on pig iron and ferro-alloys;
- Import duty on finished castings should be higher than the duty on foundry raw materials.

To resolve some of these issues and to provide support services for the various foundries in the country, the Federal Government should establish, without further delay, the National Foundry Development and Training
Centre. Such a centre will provide practical training courses for manpower development. It will carry out research work on foundry materials and analysis of final castings.

CASTING RAW MATERIALS

Foundry raw materials can be classified into two types:

1. Raw materials that are directly related to the end products. They are inputs such as scrap iron; pig-iron additives. The amount of raw materials to be used-for particular casting depends on the chemical analysis of both the raw materials and the end products themselves.
2. Raw materials that are directly related to the end products. These are bentonite, silica sand, binders, oil and gas. The consumption of these materials is not dire related to the output of castings [6].

All the raw materials required for foundry operations are available in various parts of the country. Silica sand is available in large quantity in Ondo State. A glass factory located by the deposit is able to treat the sand and make it suitable for casting in the foundry. Our cities will be cleaner if all the metal scraps ("tokunbos") on our roads can be removed and deposited at foundry sites as raw materials. The country can boast of adequate availability of foundry industry in Nigeria. The extraction and processing of the raw materials will create upstream employment for the jobless school leavers [2]

RESEARCH AND DEVELOPMENT

By its nature, foundry industry belongs to the heavy basic industry. Therefore, attention must be paid to such issues as:

- Air pollution control
- Industrial waste control
- Safe working environment

These issues which could be hazardous need research information for the development of suitable equipment for their control. Research laboratories are required in the universities and major foundry centre to carry out analysis of raw materials and finished products. Post-graduate students should be able to carry out their final thesis on foundry related topics. This will increase the volume of knowledge and promote further development of the foundry industry.

NEW DEVELOPMENTS IN THE FOUNDRY INDUSTRY

There are practically no new foundries in Western Europe in the last 10 years. The reasons for lack of new investment in the industry are difficult to track. The hazardous nature of the industry with the attendant air pollution could be partly responsible for this trend, particularly in this era of environmental protections. To minimize the damage to the environment and reduce environmental costs, our parent company in the Netherlands, Gemco Engineers b. v., developed the "Lost Foam Casting Technology" after many years of expensive research. This new technology which is attracting global interest provides both product designer and foundry technicians with new possibilities and benefits. This is because the lost foam mould allows virtually limitless complexity with respect to the moulded foam. It also makes it possible for the final casting to be exact as possible to the component required so that subsequent machining is reduced to the barest minimum, if at all [5]. Using lost foam technology, highly complex products can be produced with utmost precision. This means that it is now possible to integrate various components into one casting, which would previously have required many castings, machining, gaskets and assembling. This initiative brings higher technology into the foundry industry and is generating new interest for the industry in Europe. The first full scale turnkey lost foam project was launched in 1996 in the Netherlands. A number of automotive companies are already applying the new technology. Negotiations are currently going on with several potential clients in South Africa and in Zimbabwe. They are already thinking of investing in this technology in order to complete and offer better products at lower cost to customers in South Africa and abroad. The questions we must ask ourselves are: Should Nigeria delay in acquiring this new technology only to import finished casting from South Africa and Zimbabwe? Or should we join the race for the new technology by incorporating it into new foundry projects? When shall we stop importing "tokunbo" engines and when shall we start to produce new engine blocks from our own foundries? By extension, when shall we build a truly Nigerian car? Where do we start from?

THE AUTOMOTIVE INDUSTRY

Earlier in this paper, we mentioned briefly about the automotive industry. The time is overdue for Nigeria to build her own car. The Centre for Automotive Design and Development (CADD) in Zaria, a parastatal of Federal Ministry of Industry, has done a lot of ground work on this subject. CADD has listed all components that are obtainable from local producers in Nigeria. Such parts as tyres, screens, seats, etc. The crux of the matters is that all these components cannot move without an engine. There is no handy statistics available on the value of imported "tokunbo" engines into this country but it is quite clear that millions of US dollars are spent annually. What we are proposing is that a 'dedicated foundry' should be established for the automotive industry designed essentially to produce car engine blocks. Just as the Nigerian Machine Tools Industry was designed to produce tools, this new foundry should be capable of producing engine blocks that can be adapted to suit existing car bodies. Our local mechanics are indigenous. They have, for example, succeeded to adapt to over 60% of the old cars on our roads. Such engine blocks can be cast from the same foundry. The advent of the lost foam casting technology makes this idea more viable. Decision makers in government and the organized private sector must look critically at the need to save lives on our roads by finding a solution to the replacement of the rickety mobile coffins called 'tokunbo' cars with cheap but reliable local alternatives. The local alternative will come only when we start casting engine blocks locally. We can do better than India, Pakistan and even South African.

CONCLUSION

1. It is acceptable fact that foundry technology is essential for industrial development. For Nigeria to develop the know-how and skills, she must embark on the training of personnel at al levels. Our educational institutions must produce knowledgeable craftsmen, qualified technicians and professional engineers,
2. Funds are required to acquire both the hardware and software. Deliberate and special allocation of funds must **be made to set up** foundries focused on specific national needs e.g. automobile, machine tools, etc. Working capital should be provided as and when required so that the foundries could be run as commercial and profitable enterprises. Ajaokuta and Aladja foundries should be revived. NMT should be completed and return to production.
3. Government must remove all laws, decrees and regulations that hinder the development of the foundry industry. The environment must be conducive for investors to be willing to invest in the industry in Nigeria.
4. Raw materials are located in various part of the country. The Raw Materials Research and Development Council could be of help here. The information must be made available to potential investors in the Nigeria foundry industry.
5. Research and Development (R&D) requires capital investment. If we must make progress and develop side by side with other progressive nations of the world, R & D must be given high priority in the national budget. The nation must learn to be patient because the returns will come many years after.

RECOMMENDATIONS

1. To achieve the objectives stated above, the following recommendations are put forward to the decision makers.
2. For the country to produce the required manpower for the foundry in the foreseeable future, at least three Technical Colleges (or Trade Centres), two Colleges of Technology (or Polytechnics) and one university in each state of the federation should include courses in foundry technology in their curriculum. Without trained manpower at all levels, investments in foundry industry will produce little returns. The States and Federal Ministries of Education and the Nigerian Universities Commission (NUC) could make this

recommendation happen from next session.

3. The Nigeria Machine Tools company at Oshogbo should return to its original concept of producing machine tools for this country. Tools like lathes, milling machines, drills, presses, power saws, vices, etc. are primary machines needed to produce industrial plants and machinery to the benefit of other countries such as Malaysia, Indonesia, South Korea, etc., not to mention Western Europe and the USA.
4. The time is overdue for Nigeria to produce her own car, cheap enough for the masses and reliable enough for their safety. This is the only way to stop the importation of all kinds of junks and rejects from all over the world to Nigeria. To do this, a foundry dedicated to the production of car engine blocks should be established in the country.
5. Nigeria should take the lead in Africa in the acquisition of new technology called the Lost Foam Casting Technology which will improve the quality of our castings to international standards and make them available at competitive prices. The technology will also reduce environment pollution associated with foundry industries.
6. Finally, the establishment of the National Foundry Development and Training Centre is long overdue. Such a centre will provide facilities for practical training of all cadres of foundry workers. It will be a research centre for foundry raw materials and an analytical laboratory for finished castings. Such a centre will lay a solid foundation for rapid industralisation of the country and be a focal point of further development of foundry technology in Nigeria. We strongly recommend the physical establishment of such a centre as priority project of government and institutions.

Finally, we hope we have created an awareness of the important position of foundry technology in our desire for industrial development. If our recommendations are implemented, Nigeria will be the better for it. Once more, we congratulate Ceramic Association of Nigeria on this year conference.

ANNEX I

Casting Demand Per Sector. 19961

Description	Tonnage Per Annum
Cement sector	8,300
Machinery sector	12,000
Agricultural machinery	12,000
Household sector	8,100
Automobile sector	55,000
Tool sector	15,000
Ship-building sector	5,400
Mining sector	11,500
Electrical sector	15,000
Building sector	11,900
Railway sector	8,600
Other sectors	22,200
Total	185,000

Source: Raw Materials Research and Development Council

ANNEX II

Casting Demand Per Metal Time, 1996.

Description	Tonnage Per Annum
Grey and malleable cast iron	120,000
Steel	31,500
Non ferrous	33,500
Total	185,000

Source: Federal Ministry of Science and Technology

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