

Steel Sector Repositioning: Gateway to Sustainable Nigerian Industrial Development

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Abstract— Steel is at the heart of economic and sustainable development of any nation. It is one of the materials most widely used by all sectors of the economy, from resource-efficient building structures to energy-saving transport and infrastructural systems to environmentally-friendly industrial development anchored on clean renewable energy and recyclable products. Considering that the most advanced economies of the world produce and consume large quantities of steel and trying to assess the challenges confronting Nigerian industrial development, the state of Nigerian steel development is evaluated in this research. This paper researches into the state of steel production and consumption in Nigeria. Data collected on Nigerian steel industries and the best practices in the international scenes are statistically analyzed. The results obtained clearly shows that the root of poor performance of Nigerian economy is due to the poor performance of Nigerian steel industry. The paper proposes way out for the repositioning of Nigerian steel industry and then for the true Nigerian Sustainable Industrial Development.

Index Terms— Steel, Sustainable Development, Industrialization.

I. INTRODUCTION

Steel is essential to all solutions of the society's daily needs as it is indispensable to housing, infrastructure, transport systems, manufacturing, agriculture, water and energy supply. Steel is at the center of world economy and worldwide, the steel industry adopts approaches that enhance sustainable development striving to meet the present needs without compromising the ability of future generations to meet their own needs [1]. This delivers wealth for all nations, wealthy and poor alike, while preserving and enhancing the planet's resources. The very many challenges experienced by the developing nations such as population growth, inability to meet up with urbanization needs, high level of unemployment and ever increasing rate of poverty by can alleviated by steel. Steel industry and allied factories transforming steel to finished products absorb a lot of labor force in any society.

Research and development strategies adopted by the steel industry since industrial revolution till have contributed immensely to the advancement of the world.

The qualities of steel such as strength, recyclability, availability, versatility and affordability makes it a unique material. In fact, once steel is produced it becomes a permanent resource to the society because it is 100% recyclable without loss of quality and has a potentially endless life cycle [1]. The recyclability and versatility have brought about countless innovations. While the steel industry is energy and carbon intensive, research and development investments are cushioning the environmental impacts.

Steel industry is one of the most efficient manufacturing process as most by products processed to finished products or used in manufacturing process such as cement factories. Over 22 billion tonnes of steel has been recycled worldwide since 1900 owing to steel's 100% recyclability [1].

A look at the trend of steel industries worldwide shows that the largest economies of the world produce and consume large quantities of steel whereas the less-performing economies including Nigeria have a very low steel production and consumption capacities. Given the great potentials of steel materials and how it is impacting on the economies of the advanced nations, this paper researches into the state of steel production and consumption in Nigeria. Data collected on Nigerian steel industries and the best practices in the international scenes are statistically analyzed. Particular attention will be placed on the steel used for buildings and infrastructural development.

II. LITERATURE REVIEW

Steel is produced principally from iron which is one of Earth's most abundant elements and recycled steel. Steel

is manufactured under carefully controlled conditions in specialized plants. The steel material technology have grown exponentially in the past 100 years as shown figure 1.

The properties of every type of steel are determined in a laboratory and described in a manufacturer's certificate. Thus, the end user only specifies the steel complying with a relevant standard, and the fabricator ensures that the correct steel is used appropriately [1-2]. In order to appreciate the great potential of steel to the economy, this research considers more in depth the application of steel in the construction industry.

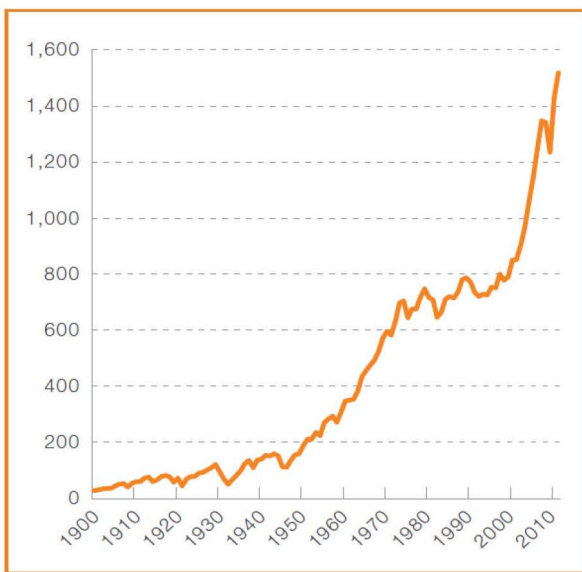


Fig. 1. World crude steel production, 1900-2011 (Mt) [Source WSA, 2012]

Steel in Construction

Steel plays an essential part in the growth of any modern society. Construction industry is a very important sector of every nation's economy. It is one of the most important steel-using industries, accounting for more than 50% of world steel demand.

From steel reinforced concrete residential buildings, to industrial buildings, to structures for public use, to high rise buildings. All these structures rely on steel for their strength and ductility. Steel is also used on roofs and as cladding for exterior walls. Figure 2 shows the World consumption of steel per sector in 2013 [3]. Construction industry consume as much as 52% of World steel.

Steel can be adopted in two major ways in construction: as reinforcing bars for reinforced concrete structures or as stand-alone material for construction. In developing nations like Nigeria, steel have been used mainly for reinforced concrete structures while in the developed nations, steel frame structures are well developed and practiced.

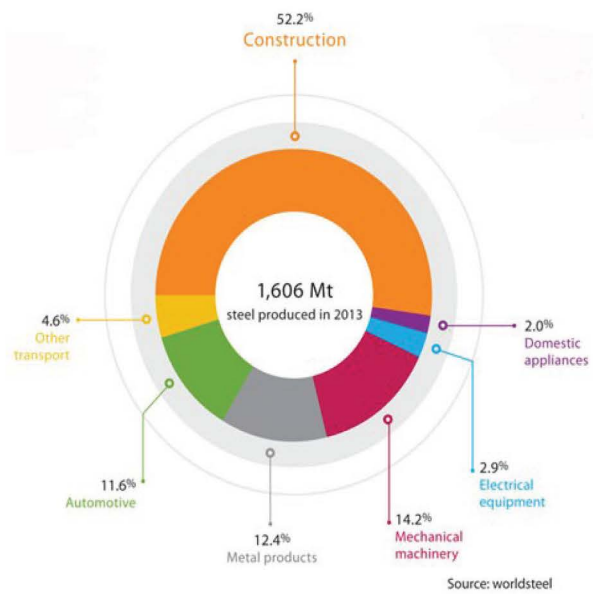


Fig. 2. Steel usage by sector in 2013 [Source: WSA, 2014].

Reinforced concrete is a composite material per excellence [4] and is widely used because of the complimentary properties of concrete and steel. Very good concrete compressive strength is efficiently combined with the high tensile strength of steel to provide the world with the most accepted material for buildings and infrastructures.

Concrete and steel provide complementary support to each other, compensating for the weaknesses in their properties [5] and thereby making the material a very ductile construction material. The reinforcing steel bars are produced in specialized industrial set up and generally come with certified quality. The quality of cement, the binder of concrete, is also produced in specialized factory similar to steel factories and is guaranteed by the manufacturer in a manner similar to that of steel. Unlike the choice of steel for structural applications, the choice of concrete mixes is virtually infinite and therefore the selection has to be made with a sound knowledge of the properties and behavior of concrete. The application of reinforced concrete material is not without attending challenges in different parts of the world [6]. In Nigeria where building collapse is common, it turns out that most of the collapsed buildings are concrete structures [7]. The quality of concrete material and steel reinforcement used in Nigeria buildings have been severally mentioned as the possible causes of building collapse as test results confirmed general low quality.

Steel frame structures are used for over 90% of single storey, non-domestic buildings, roofing for super markets, big outlets sports, holiday centre and weather controlled environments [8]. Steel for structural frame offers designers more design freedom in strength, flexibility and shapes. The adoption of steel as main frame structure is for strength, beauty, precision, malleability, light weight,

long span up to 60m and even above, durability, reduced time of erection, versatility of application, cost, endless recyclability and potential for easy change of layout several times during the building's life. The long spanning ability gives rise to large open spaces, e.g. the roofing of the over 100m span Faith Tabernacle, Canaan Land, Ota, Nigeria, free of intermediate columns or load bearing walls. The capacity to bend to a certain radius, creating segmented curves or free-form combinations for facades, arches or domes sets it apart. Steel materials lend for industrialization of products and the factory-finished construction elements comes with the most exacting **specifications** under highly controlled conditions. This makes the quality of final product more predictable and repeatable, eliminating the risk of on-site variability. For more challenging sites, steel allows less points of contact with the earth, reducing the amount of excavation required and costly foundations. The efficiencies of steel construction leads to substantial resource efficiencies and economic benefits, including accelerated project schedules, reduced site activities and earlier returns on investment.

State of African Steel

It is predicted that sub Saharan Africa's construction industry will grow from \$75bn in 2013 to about \$180bn by 2025 [9]. Currently, African producers are unable to meet the demand for steel especially the reinforcing bars which is why steel import is high. To meet up with the high demands, fraudulent activities are rife in the steel sector as poor standard products are easily supplied leading to frequent building collapse that have been verified in Nigeria [10]. The need for increased local investment in the steel sector and the enforcement of international standards cannot be over-emphasized. These needs create great opportunities for African investors to see off competitors and help to boost African economies. Apart from South Africa and Egypt that are leading the way, most African nations are in a very bad shape. In 2013, Kenya produced about 20000 tonnes of crude steel which is too far off from the national demand of about 1.2 million tonnes. Efforts to improve production will have to contend with the issue of cheap steel import that is frustrating the efforts of indigenous African companies from growing. Dumping of finished foreign products is taking people out of business in Africa.

In 2013, Africa's share of World crude steel production was 1% and finished steel products for the same year stood at about 2%. Annually, Africa import over 25 million metric tonnes of finished and semi-finish steel products with Algeria, Egypt, Nigeria, South Africa and Morocco leading. Apparent steel use per capita for 2013 were 105.8 kg and 88.9 kg for South Africa and Egypt,

respectively. On the World stage, data on Nigeria steel are missing since 2008 based on World Steel Association data. While South Africa and Egypt forge ahead, Nigeria lags behind. In 2013, South Africa crude steel production was 7.3 million metric tonnes while Egypt produced 6.8 million metric tonnes. Rebars accounts for about 80% of all steel sales in Egypt. In 2014, the government imposed a temporary tariff on imported rebar to fight the dumping of rebar from China and Turkey.

In Nigeria, the domestic industry has been greatly hurt by poor provision of electricity. Ajaokuta Steel Company with theoretical capacity of 1.3m tonnes of long steel products have been lying inactive due to neglect of successive governments, managerial inefficiency, poor power supply and lack of fund to complete the final phase. Nigeria currently spend about \$3.3bn annually on steel and iron imports. In 2013, the local industry produced an estimated 100,000 tonnes of crude steel, which is just about 0.6% of Africa's total. Data on Nigerian's steel capacity is appalling when compared to other nations of similar size and economic might around the world. The current number of functional steel rolling mills in Nigeria is estimated at about 21 up from about 5 functional steel rolling mills 5 years ago. There are 15 steel rolling mill producing reinforcing bars, about three cold rolled steel mills producing cold rolled flat plates and about three producing wire coils [11].

III. METHODOLOGY

Having seen the importance of steel to the World economy with the highlighted examples of steel production and consumption in the World, Africa and Nigeria with particular emphasis on the applications to the construction industry, we now analyze data on steel production and usage in the World, Africa and Nigeria. Secondary data were collected from various sources such as World Steel Association [1], [3], World Bank [13], World Population Review [14], etc. MS Excel generated bar charts were employed in evaluating the data collected.

IV. RESULTS AND DISCUSSIONS

Here the results obtained from the data analysis are presented.

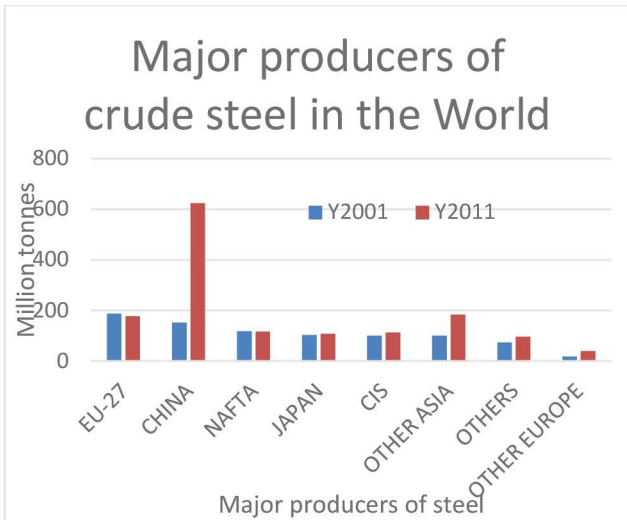


Fig. 3. Major producers of crude steel in the World
 Figures 3 and 4 show the World production of crude steel and finished steel products, respectively for 2001 and 2011. Figure 5 shows the top 5 Gross Domestic Products of the World for 2013.



Fig. 4. Major producers of finished steel products in the World

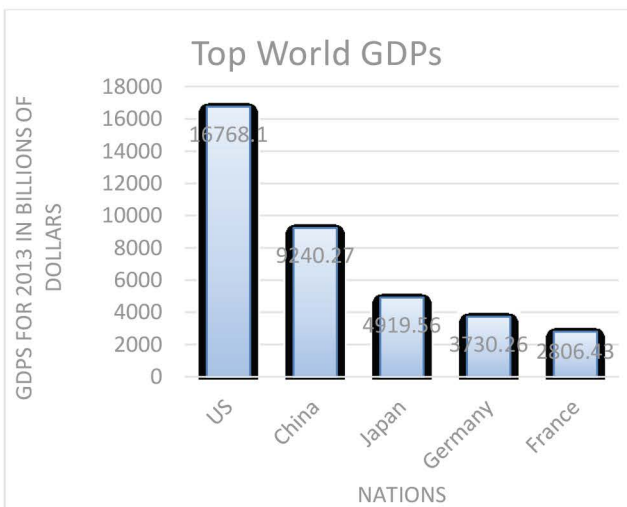


Fig. 5. The top 5 Gross Domestic Products in the World for 2013.

A look at these figures show that the top 5 nations with the highest Gross Domestic Products (GDP) are also among the highest producers of crude steel and finished steel products. Figures 6 and 7 show the top 5 most populated African nations and the top 5 Gross Domestic Products (GDPs) respectively for 2013. Figure 8 shows the top 5 African crude steel producing nations with Nigeria inserted within their mist. Figure 9 shows steel production per sector in Nigeria.

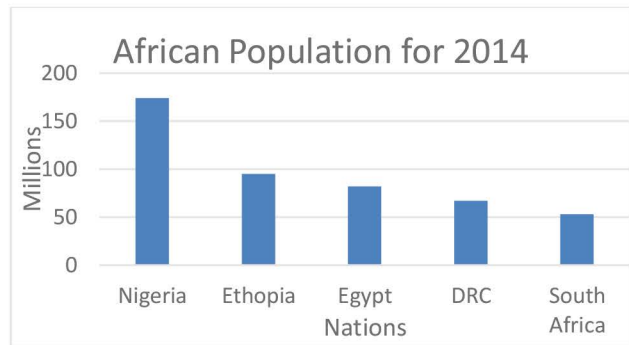


Fig. 6. Top 5 African Population for 2014

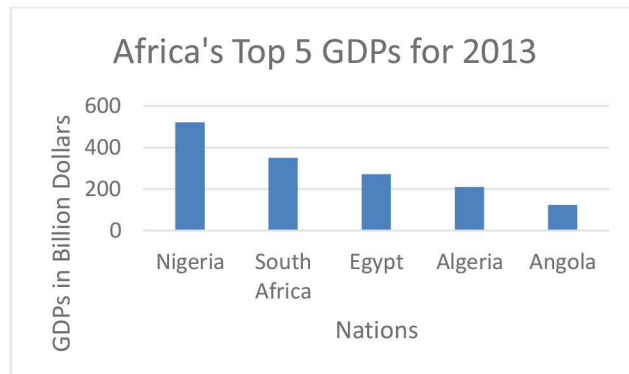


Fig. 7. Top 5 African Gross National Products (GDPs) for 2013

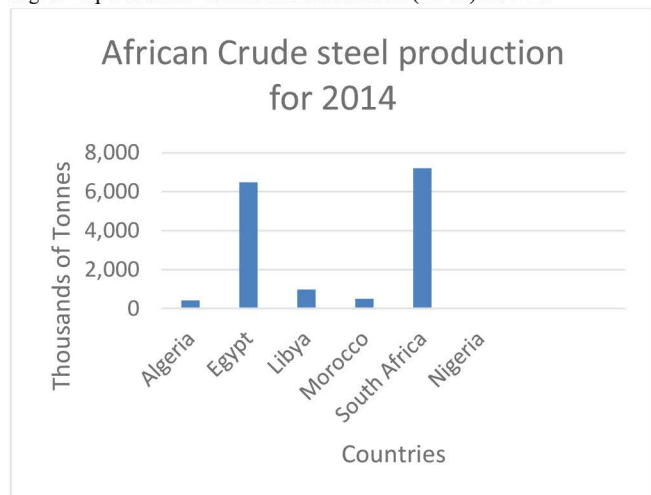


Fig. 8. African Top Crude Steel Production for 2014

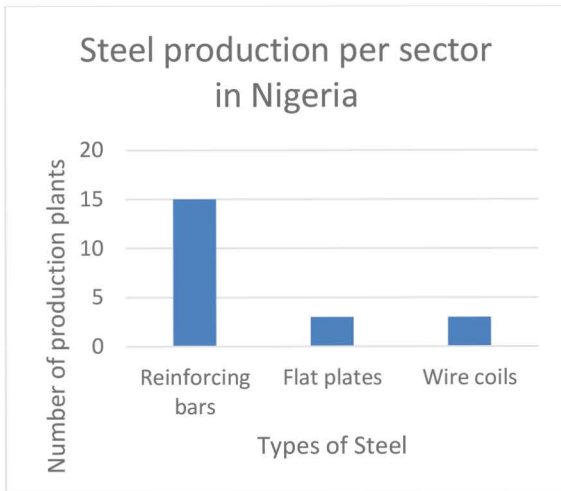


Fig. 9. Steel production per sector in Nigeria

From figures 7 and 8, it can be seen that Nigeria with its largest population Africa has also maintained the African's largest economy. South Africa and Egypt with the second and third largest African economies are also among the top 5 most populated African nations. Currently, Nigeria is the most populated and the leading economy in Africa. However, figure 8 shows that Nigeria is conspicuously missing in Africa's steel production [15]. The top leading steel producers in Africa, South Africa and Egypt are also the second and third largest economies respectively in Africa. That these two African large-economy nations are also the leading steel producers is in tandem with what is obtainable among the top World economies and the top steel production in the World. The prosperity of the advanced nations is reflective on their capacity to produce crude steel and finished steel products. That Nigeria with her large economy in Africa is not found among the top steel producers is an anomaly that have a lot to say about the nation's future sustainable developmental strides. Over the recent years, so much progress have been made in the steel industry world wide and the development of steel material technology have corresponded to enabled economic advancement. Nigerian's low capacity in steel material technology is showing in her poor performance in industrial sector of the economy, starting from the power generation and manufacturing sectors.

V. CONCLUSION

From the research, it can be seen that steel is at the heart of any nation's economic development as it is one of the most important materials adopted for everyday activities for both domestic and industrial applications. Demand for steel is very high in Nigeria and in the whole continent of Africa. The low capacity of the Africans in meeting up with their basic needs including the steel industries needed to drive their economies are all linked to the misplacement

of priority by successive African Governments. Except for Egypt and South Africa, African nations are conspicuously missing in the 2014 World Steel Association's report on World steel production, consumption and exportation. That Nigeria does not feature within the top 50 steel producing nations of the World suggests lack of capacity for sustainable development. All leading economies of the World are also the leading steel producers. Until steel sector is developed, African economies will continue to move at a snail's pace. For the steel producing factories operating in Africa, it will be needful that they operate by the WSA high standard to reduce the risk of structural failures that have been verified in some African nations. An energetic steel sector will accelerate the industrial development of Nigeria as it exploits the nation's abundant natural resources and contribute immensely to the growth of the gross Domestic products (GDP). Steel industry and allied factories transforming steel to finished products have always absorbed large labor force in steel producing nations. A vibrant steel sector will engender mass economic activities that will create jobs and solve the persistent problems of unemployment in Nigeria. The tenacity involved in the steel sector will improve technical skill acquisition that can be easily transferred from one sector of industrial set up to the other sectors of national economy. Massive job opportunities and economic empowerment will be created for engineers, technicians, artisans and fabricators alike. Greater investment in the steel sector will definitely serve as a spinoff for Nigerian Technological advancement on which sustainable national development will ride upon.

To revitalize steel material technology in Nigeria, policy makers must create enabling environment for the steel industry to flourish. Necessary infrastructures must be made available. Basic technical education must become a priority with at least one technical secondary school in every of the nation's 774 LGAs. These schools will prepare the students for all technical sectors of the economy. It must be understood that the nations's educational needs at the grass root level are different from those adopted by advanced nations such that a special model of technical education must be created to suit the nation's need. The burning desire of young Nigerians to acquire quality tertiary education must be built on a solid foundation of basic technical education other wise the gap between the the graduates and the low technical class will be so enourmous that the senergy for sustainable national development will be difficult to build. More funds must be made available for primary research and pilot projects that will explore technical and economic feasibility of ground breaking new technologies.

The success of these tasks will require the helps of the governments, corporate bodies, missionary agencies and well-meaning Nigerians. Only then will the nation be repositioned for sustainable national development.

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