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Repositioning of an Engineering Works Complex as an Industrial Hub for Spare Parts and Components Production

Onakemu A. Oyibo[1], C. Ocheri[2*], David O. Adidi[3], Sani M. Adams[4]

[1,3] Dept. of Welding and Fabrication Engineering & Department of Mechanical Engineering, Delta State Polytechnic, Ogwashi-Uku, Nigeria
[2,4] Dept. of Metallurgical and Materials Engineering, University of Nigeria, Nsukka, Nigeria

*Corresponding Author's Email: cyril.ocheri@unn.edu.ng (Ocheri C.)

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ABSTRACT

Ajaokuta Steel Company Limited (ASCL) comprises several units, including the Engineering Works Complex, which is one of the key auxiliary units of the steel plant. This complex is equipped with the necessary tools and machinery for producing fixtures and spare parts that meet a wide range of requirements. These machines are operated by well-trained engineers, skilled technicians, and artisans. The complex is designed to carry out repairs on equipment across the entire steel plant, as well as to manufacture spare parts for external agencies. Additionally, facilities are available for training technicians and artisans. The Engineering Works Complex consists of five major workshops: the Machine and Tools Shop, Forge and Fabrication Shops, Foundry and Pattern Making Shops, Power Equipment and Repair Shops, and the Rubberizing Shop. It is fully equipped to meet the industrial demand for spares and consumables, and it has the capacity to serve as a research institution where modern research can be conducted. This research aims to explore the potential of repositioning the Engineering Works Complex at Ajaokuta Steel Company as a leading industrial hub for the production of spare parts and components in Nigeria. The study will analyze the potential economic benefits of this repositioning, such as increased employment opportunities, higher productivity, and greater contributions to the national economy. By drawing on case studies from other countries that have successfully developed their engineering sectors, the research will provide insights and lessons that can be applied to the Nigerian context. The Engineering Works Complex is actively utilizing the government's local content policy to achieve these goals. With the necessary attention, including adequate funding for the various shops within the complex, it could generate significant revenue and create employment opportunities in downstream industries, ultimately contributing to the industrialization of local communities and the country at large.

Keywords: Ajaokuta Steel Company; Engineering works; Industrial hub; Local content policy; Spare parts.

1. Introduction

The Engineering Work Complex of the Ajaokuta Steel Company Limited (ASCL) is equipped with various facilities for the manufacture of equipment and spare parts, as well as for the repair and reclamation of spares. The design envisages that about 70% of the capacity utilization would meet the steel plant requirements, whereas the balance of 30% can be used for meeting external job orders. The plant, in particular the Engineering Work Complex, has been taking up jobs for both the private and public sector industries in Nigeria. Specifically, ASCL has business relationships in the repair of equipment and manufacture of parts with the following industries: Kaduna Refining and Petrochemical Company, Warri Refining and Petrochemical Company, Port Harcourt Refinery, Unipetrol, West African Portland Cement Company, Cement Company of Northern Nigeria, Sokoto, Ashaka Cement, NEPA, Shiroro, Delta Steel Company, Jos Steel Company, Oshogbo Rolling Mill, Union Steel Company, Nigerian Railway Corporation, and Port Harcourt Aluminum Company.

The repositioning of an engineering works complex as an industrial hub for spare parts and component production is a strategic initiative that aligns with Industry 4.0 principles and sustainable development goals (Kagermann et al., 2013). Industry 4.0 is characterized by the integration of physical and digital systems, which facilitates the creation of smart factories and industrial hubs designed to enhance efficiency and productivity. This concept of enhanced efficiency is supported by Slack et al. (2004), who emphasize the importance of streamlining production processes and reducing lead times to meet the demands of modern industries. Additionally, the goal of increased competitiveness is central to this initiative, as competition drives improvement across various fields (Porter, 2008). Porter explores how competition acts as a powerful force for progress and how understanding it can lead to significant advancements. In parallel, Prahalad and Hamel (1990) argue that a company's core competencies—its collective knowledge of how to integrate diverse production skills and technologies—are crucial for success. They liken a diversified company to a tree, where core products represent the trunk and major branches, business units are smaller branches, and end products are the leaves and fruit. They propose that focusing on core competencies allows companies to build unique, integrated systems that offer a competitive advantage and adaptability in a changing market (Prahalad & Hamel, 1990). By clarifying strategic intent, investing in necessary technologies, and forging strategic alliances, companies can enhance their core competencies to cater to various industries and remain competitive.

Research and development (R&D) are critical components of this strategy, as they enable the development of new materials, technologies, and processes (R&D Magazine, 2020). Skills development is another essential aspect of repositioning an engineering work complex, as it ensures that the workforce is equipped to meet the demands of modern manufacturing and production techniques. Supply chain optimization is also crucial, as it enables companies to create efficient and resilient supply chains (Mentzer et al., 2001). Finally, the concepts of environmental sustainability and economic inclusion are integral to the repositioning of an engineering work complex.

Sustainable development requires meeting the needs of the present without compromising the ability of future generations to meet their own needs. Similarly, economic inclusion is critical for promoting social stability and prosperity. The World Bank is an international financial institution that provides loans and other financial assistance to developing countries to help them achieve their development goals (World Bank, 2019). The World Bank's mission is to reduce poverty and promote economic growth and sustainable development in developing countries. The World Bank's report on economic inclusion highlights the importance of ensuring that all individuals and groups have access to economic opportunities and resources and that they are able to participate fully in the economy. The report argues that economic inclusion is a necessary step for sustainable development, as it can help reduce poverty and inequality and promote economic growth and stability.

The Ajaokuta's Engineering Works Complex, which includes the production of spare parts and components for a range of industries, has the potential to become a leading industrial hub in the country. However, the sector faces numerous challenges that have limited its growth and development. These include inadequate funding, limited access to skilled labor, poor infrastructure, and outdated regulatory frameworks. Despite these challenges, there are significant opportunities for repositioning the engineering works sector as a key driver of economic growth and technological innovation in Nigeria. This research will explore the factors that have hindered the development of the sector and identify strategies for overcoming these obstacles to unlock the sector's full potential.

The engineering works complex consists of a diverse range of industries, including automotive, aerospace, construction, energy, and manufacturing. However, despite the diversity of the sector, there are common challenges that limit its growth and competitiveness. One of the major challenges is limited access to funding. Many engineering firms lack the capital needed to invest in new technologies, expand their operations, or develop new products and services. This is partly due to the lack of a well-developed venture capital and private equity industry in Nigeria. Another key challenge for the engineering works sector is limited access to skilled labor. Many firms struggle to find qualified engineers, technicians, and other professionals with the necessary skills and expertise to support their operations. This skills gap is exacerbated by the country's high unemployment rate and underinvestment in vocational training and education. Inadequate infrastructure is also a major hindrance to the growth of the engineering works sector. The lack of reliable electricity, transportation networks, and communication systems makes it difficult for firms to operate efficiently and compete in global markets.

In their work, Agha et al., (2021) discusses the importance of engineering and infrastructure in Nigeria's development. The authors argue that the government should prioritize engineering and infrastructure development to achieve economic growth and alleviate poverty. They also emphasize the need for institutions to oversee service provision, regulate and monitor quality, and coordinate projects efficiently. The article concludes by highlighting the significance of good-quality engineering and infrastructure in avoiding bottlenecks and supporting economic activities. The authors recommend that the government ensure standard policies and effective evaluation of contracts for proper implementation. Shittu et al. (2020) examined the potential benefits of local manufacturing and spare parts production in Nigeria, including job creation, economic growth, and technological development. Ojo et al. (2023) discussed the importance of optimizing inventory inflation budgets for the automobile industry. The authors used the non-preemptive goal programming model to optimize the inventory inflation budget. The model was implemented on different types of vehicles to predict the cost of procurement of spare parts and miscellaneous items and the profit for the current year. The result proved that the solution did not fully achieve the goals since the objective function is not equal to zero, but deviations for going below the profit goal and above the cost of procurement goal were significantly minimized. Amoo et al., (2017) explored the relationship between private sector credit and economic growth in Nigeria, examining how credit availability and access impact economic development. They employed statistical analysis and data to investigate this relationship and draw conclusions about the role of private sector credit in Nigeria's economic growth. Ajibode & Adebayo (2023) examine the role of innovation and local capacity development in driving growth and competitiveness in the Nigerian automotive industry, highlighting the importance of policies and initiatives that support innovation, such as investment in research and development, human capital development, and technology transfer. Adeleye & Igwe (2023) review government policies aimed at fostering industrial development in Nigeria, focusing on infrastructure, education, and research, emphasizing the need for an enabling policy environment for private sector investment and innovation. Ogu (2016) study the role of entrepreneurship and innovation in the Nigerian energy industry, while Lawal (2020) discuss the potential of technology, including automation and digitalization, to drive growth in the Nigerian engineering sector. Ujam (2022) highlights the importance of enhancing engineering education in Nigeria through effective curriculum design, academic support, infrastructure, and research facilities, and underscores the need for industry-academic collaboration and supportive government policies. Igbaroola et al. (2020) examine the role of technological innovations in revitalizing the Nigerian metal industry, stressing the need for government support in research, technology transfer, and regulatory environment. Nduka & Ogunsanmi (2015) report on a survey of industry stakeholders in the Nigerian engineering sector, identifying key challenges and opportunities for growth. Ibrahim & Umar (2023) propose a strategy for repositioning the Nigerian engineering works sector, emphasizing local manufacturing capabilities, innovation, and an enabling policy environment. Okpara (2022) discusses the development of local manufacturing capabilities, highlighting the importance of policy interventions, technological advancements, and human capital development. Ogundele et al. (2014) examine the challenges and opportunities for industrial development in Nigeria, including the roles of government policy, private sector investment, and international trade. Ezirim et al. (2023) study the historical roots of Nigeria's industrial development, focusing on colonialism, the petroleum boom, and political instability. Okonkwo (2019) underscores the critical role of infrastructure, including transportation, energy systems, and telecommunications, in industrial development. Ogunsemore (2014) examines the role of SMEs in driving industrial development in Nigeria, focusing on policy interventions to support SME growth and competitiveness. Together, these studies highlight how essential it is for Nigeria to focus on smart government policies, embrace technological advancements, and build local expertise to fuel industrial growth. They show that for the country to make real and lasting economic progress, it's crucial for both public and private sectors to work together and invest wisely in these areas.

2. Machine and Tool Shop

This shop is equipped with a group of general-purpose machines. It has the capacity to manufacture new spare parts and reclaimed parts for more than 22,000 metric tons a year. The shop can also handle fittings and provide general assembly services to industries supplying batch production companies. Facilities are available for heat treatment and electroplating; the principal equipment includes an electrical bogie-type furnace, an electroplating unit, electrical heat chambers, furnaces, etc. (Vichare et al., 2018).

2.1 Basic Capabilities

2.1.1 Turning

The shop houses two turning machines, each designed for different applications. Machine 1 has a maximum diameter of 800 mm and a maximum length of 12 meters. It is suitable for turning large, heavy workpieces, such as industrial equipment components, ship propellers, or long shafts, making it ideal for industries like shipbuilding, heavy industry, and construction equipment manufacturing. Machine 2, with a maximum diameter of 3200 mm and a maximum length of 5 meters, is designed for smaller, more precise workpieces, such as precision parts, tooling, or machinery components. This machine is commonly used in precision engineering, tooling, and automotive parts manufacturing.

2.1.2 Milling

The milling capabilities of the shop include a machine with a table size of 400 mm x 1600 mm, suitable for various milling operations.

2.1.3 Planning

The planning machine in the shop has a maximum table size of 1400 mm x 6000 mm, making it suitable for handling and processing large materials or components. This machine is used for various functions, including providing a large work surface for precision engineering, machining, or fabrication tasks that require a stable and accurate work surface. It is also used in various manufacturing processes, such as metalworking, woodworking, or composite production. Additionally, it might be a computer numerical control (CNC) machine capable of automated processing and precision cutting or drilling, making it suitable for industrial-scale applications in aerospace, automotive, or construction-related manufacturing.

2.1.4 Horizontal Boring

The horizontal boring machine has a maximum machining area of 2500 mm x 2000 mm, indicating a significant capacity for processing large and complex parts. It is designed for horizontal boring, which involves drilling precise holes or machining surfaces in a horizontal orientation. This machine is likely used for high-precision engineering applications, such as heavy machinery manufacturing, aerospace components, power generation equipment, and large industrial equipment. Its large machining area and horizontal boring capability suggest high-accuracy machining requirements, suitable for industrial-scale production in a manufacturing plant or heavy engineering facility.

2.1.5 Cylindrical Grinding

The cylindrical grinding machine has a maximum grinding capacity of 400 mm in diameter and 2800 mm in length. It is designed for precision grinding of cylindrical surfaces, ensuring high accuracy and surface finish. This machine is used for high-precision engineering applications, such as aerospace components, automotive parts (e.g., engine cylinders, gear shafts), industrial equipment (e.g., bearings, pistons), tooling, and machinery components. The machine's capability to achieve high surface finish and precision makes it suitable for applications where surface quality is critical, indicating its use in industrial-scale production, possibly in a manufacturing plant or precision engineering facility.

3. Heat Treatment

The equipment referred to is a Heat Treatment furnace or facility, with a maximum capacity to handle a charge (load) of up to 30 tonnes (metric tonnes). This high-capacity heat treatment facility, capable of processing significant quantities of materials, is likely used in industrial-scale production in industries such as aerospace, automotive, energy (e.g., turbine components), and heavy machinery manufacturing. The heat treatment processes performed by this equipment include annealing, hardening, tempering, quenching, and normalizing. It can handle large quantities of metals, alloys, or other materials, subjecting them to controlled heat treatment processes to achieve specific properties such as strength, hardness, and ductility. To ensure effective heat treatment, the equipment likely features advanced temperature control systems, atmosphere control, and monitoring capabilities.

3.1 Light Machine Bay

The Light Machine Bay is a large workshop or production area measuring 168 meters long, 30 meters wide, and 22 meters high, equipped with Electric Overhead Traveling (EOT) cranes capable of lifting up to 16 tonnes. This substantial industrial space includes various types of machine tools such as light and medium capacity lathes, horizontal and vertical boring machines, milling and shaping machines, and slotting and grinding machines. This machine bay is used for the manufacturing and production of medium to large-sized metal parts and components, heavy engineering and fabrication work, precision machining and tooling, and industrial-scale production in industries such as aerospace, automotive, or energy. The variety of machine tools and heavy-lifting capacity indicate a versatile and well-equipped production facility, capable of handling a wide range of manufacturing tasks.

3.2 Heavy Machine Bay

The Heavy Machine Bay is another large workshop or production area, also measuring 168 meters long, 30 meters wide, and 22 meters high. It is equipped with EOT cranes capable of lifting up to 32 tonnes, indicating twice the heavy-lifting capacity of the Light Machine Bay. The Heavy Machine Bay contains various types of heavy lathes, planning and plano-milling machines, heavy horizontal and vertical boring machines, and gear hobbers.

3.3 Tool Room

The Tool Room is equipped with precision lathes and milling machines, tool and cutter grinders, saw grinders, and more. It includes a Heat Treatment & Welding section comprising different capacities of both induction and gas-fired heat treatment furnaces, hardness testers, and submerged arc welding machines (Chete et al., 2021). Figures 1-4 show spare parts and components produced for various applications such as twist rollers, base frame for LSM furnace for ASCL, helical gear, and ball mill trunnion bearing, produced for DSCL.

Figure 1: Twist Rollers

Figure 2: Base Frame for LSM Furnace ASCL

Figure 3: Helical Gear

Figure 4: Ball Mill Trunnion Bearing

4. Forge and Fabrication Shop

The Forge and Fabrication Shop, which spans approximately 6600 m^2 of roofed space, is equipped with the necessary apparatus, implements, and installations to carry out its tasks. The shop is designed to forge 2,000 tonnes per annum of different materials across 10 shifts of 8 hours per week for the steel plant. Additionally, it has an excess capacity of 2,200 tonnes per annum at 11 shifts of 8 hours per week of a similar product mix available for external jobs. The maximum weight of a single forging is 500 kg. Overall, the shop can forge well above 4,000 tonnes of different materials annually. The Fabrication Shop operates with a similar shift arrangement and has a capacity for excess production and external consumption, adding up to about 3,000 tonnes per annum. The facilities can handle extensive fabrication jobs amounting to over 5,000 tonnes per annum, with the maximum weight of a single fabricated structure being 10 tonnes.

The core equipment in the Forge and Fabrication Shop includes steam forging hammers, pneumatic forging hammers, forging manipulators, heat treatment furnaces (13.7 m^3), re-heating furnaces (2.25 m^3), plate shears, 4-roller plate bending machines, and various types of welding equipment. These facilities enable the production of components and spare parts demanded by various industries and companies. For example, Figure 5 shows the forging process using a 1000 kg pneumatic hammer, Figure 6 displays the fabrication section where various processes take place, and Figure 7 illustrates the fabricated reclaimer buckets produced for NIOMCO (Iribhogbe, 1986).

The basic capabilities of the shop include:

- Maximum weight of forging: 500 kg
- Maximum weight of fabricated structure: 10 tonnes
- Plate bending: minimum diameter 650 m^2, plate size of 40 m^2 x 3150 m^2 maximum
- Plate shearing: size 32 m^2 thick
- Combination shear: for rounds up to 65 mm

5. Quality Control

The Machine Shop employs a well-trained workforce consisting of 75 machinists, 10 Tool Room Specialists, 30 Assembly and Maintenance personnel, Heat Treaters, Welders, and Quality Control personnel. The shop continuously recruits personnel to augment its capacity. Several technicians specialize in critical areas such as Quality Control, Grinding machines, and Heavy machines. Additionally, an AutoCAD draughtsman, material planners, and other skilled engineers work in the design and planning area, supporting the Machine Shop. All new positions require internal drawings. Various grades of raw material are stocked and forged to different sizes in the Forge & Fabrication Shop or cast in our Foundry.

Figure 5: Forging process

Figure 6: Fabrication shop

Figure 7: New Reclaimer Buckets, NIOMCO

6. Foundry and Pattern Making Shop

The Foundry and Pattern Making Shop, spanning approximately 19,200 m2 of roofed space, is equipped with the machinery, implements, and installations required to carry out its specialized work. These include a separate pattern shop for creating and storing patterns, a sand preparation plant, various molding tools, and a fettling shop. The foundry shop makes castings out of ferrous and non-ferrous materials and can handle gravity die cast work, repeats, and jobbing. The shop is equipped with two electric arc furnaces, a crucible furnace, an induction mixer, and an electric induction furnace, as well as additional auxiliary machinery for casting, molding, pouring, fettling, and heat treatment. It has the capacity to melt about 36,000 metric tons of ferrous metal and 3,000 metric tons of non-ferrous metal per year. The foundry shop is supported by the pattern-making shop. The core equipment of the shop includes:

- Two electric arc furnaces (6,000 kg capacity)
- One induction mixer furnace (10,000 kg capacity)
- One induction melting furnace (1,000 kg capacity)
- One Fuel-Fired Crucible Furnace (100 kg capacity) (Iribhogbe, 1991; Iribhogbe, 2000).

6.1 Basic Capabilities

The foundry shop can produce 7,000 metric tons of castings annually, including 3,550 metric tons of cast iron, 3,260 metric tons of steel, and 190 metric tons of non-ferrous metal castings. Castings made of steel and cast iron can weigh up to 5 tons, whereas non-ferrous castings can weigh up to 800 kg. A SPECTROLAB is used in the foundry shop for analyzing the chemical compositions of ferrous materials. The Pattern Making Shop, which produces patterns for both the foundry and other external industries and companies, can produce as much as 460 cubic meters of wood patterns annually. The foundry shop uses various raw materials for melting and casting components and spare parts, such as melting scrap, cast iron pigs, and ferro-alloys, which are readily available for different production mixes. Regularly cast items include jaw crushers, grinding media of various sizes, roller shells, gear and pulley castings, and non-ferrous bushes for both internal and external customers (Ocheri, 2002).

6.2 Moulding and Casting Equipment

In the foundry shop, there are several basic pieces of equipment used for molding and casting processes. Tables 1 and 2 list the molding and casting equipment, while Table 3 indicates the products produced by the Foundry and Pattern Making Shop.

Table 1: Moulding equipment

S/No	Description	Size/Capacity	Qty. (Nos)
1	Pneumatic Shaking	1600x1200x1600mm	3
2	Moulding machines	800x300x450mm	2
3	Sand Slinger	12 cu.m.per hour	1
4	Continuous Action Mixer for Cold	hardening Mixture 1 tonne per hour	1
5	Muller Mixer for sand moulding	10 tonnes / hour each.	3
6	Jaw Crusher	40 cubic /meter per hour	1

Table 2 :Casting Equipment

S/No	Description	Size/Capacity	Qty.
1	(Nos.) Electric Arc Furnace	6 tonnes	2
2	Induction Furnace (Holding) 10 tonnes	10	1
3	Induction furnace	1	1
4	Crucible Furnace	100 kg	1
5	Calcination Furnace for limestone & Ferro- Alloy	1	
6	Hot Metal Ladle	Various	1

Table 3: Products from the Foundry and Pattern Making Shop

S/No	Industry	Products
1	Cement	Grinder and crushers, crusher hammers clinker hammers, sprocket, impellers, diagrams, rollers, shafts, bolt gears & cone crushers
2	Automobile	Brake disc, crankshafts, gears, pinions, rollers, steering knuckles, callipers rock arms brake drums, carburettors bodies, connecting rods, pistons, fuel pumps, intake manifolds master cylinder body, master cylinder pistons, Transmission housing, valve rocker arms, crankcases, engine block cylinder head etc.
3	Tool	Housing for power rills butting machines, power shears, hydro press for blocks, jigs and fixtures, machine and table vices etc.
4	Textile	Pulleys, gears, frames, spanning mules, spindle nails spinning drive cylinders, sewing machine parts tricot beams, etc.
5	Steel	Pallets, moulding machine parts, shafts, and wire block, covers wire block seals, roll bearings, fitting, wire block rocker long travel rolls and roller arms.
6	Mining & Quarry	These castings require alloying resulting in high chromium and nickel, chrome iron castings. Ball mill liners, crushers sleeves, dredger pumps liners, conveyor casting, grinding balls of various diameters, Jaw crushers (fixed and swing types), cone crushers
7	Paper	Pump casing, effluent clarifiers house, bronze, brass and blanks
8	Tobacco	Drum shafts, impellers frame, and blanks for gears, vacuum pump housing and sleeves, aluminium and cast-iron blanks.
9	Ship Building	Pumps, housing gears valve bodies, propellers, cylinders, engine blocks, blower housing, water jackets, pistons, pulleys, sleeves, generator housing etc.
10	Furniture	Door locks, base for chairs etc
11	Building & Road Construction	Manhole covers, crate pipe fittings, valves, street lamp housing, door hangers etc.
12	Architectural Designers	Ornamental hard wares, Architectural fittings etc.
13	Ceramic& Refractory	Extrusion press, dies, impellers, ceramic press arm, stone polishing spirals. Die for tiles and bricks etc.
14	Agricultural & Agro-allied Equipment	Parts for mowers, ploughs and cultivating equipment, corn mill parts and plates. Oil expellers parts, Walter pumps, hand pumps etc.
15	Railway Equipment	Brake shoes components, sprocket parts etc.
16	Electrical Equipment	Motor frames, heads, refrigerator compressor parts for power lines, cast resistor, Electric base, change over switch bodies, gear switch bodies gland (dating) etc.
17	Confectioneries & Beverages	Metal moulds, crusher roller housing mill pinions, round oven pipes, hammer mill oval oven pipes, motor frames, fan housing, dust collector, low & high-pressure fan cylinders.

7. Rubberizing Shop

The Rubberizing Shop can produce various types of oil seals and adhesives and vulcanize different types of conveyor belts. The shop's outputs include:

- Joining and repairing conveyor belts by hot vulcanization with conveyor belt widths ranging from 600 mm to 2000 mm.
- Shaping and vulcanizing mechanical rubber to make seals of different shapes and sizes with maximum dimensions of 480 x 480 x 80 mm.
- Preparing pasty mixtures such as glue with viscosities ranging from 2×10^3 to 10^6 P (200 to 10^5 Pa.s).

7.1 Basic Capabilities

Table 4 gives the description of equipment, capacity, and products:

Table 4: Gives the description of equipment, capacity and products

S/NO	Equipment	Capacity	Products
1	Masticating (Mixing) Mill Roller Size	12''*24''	
2	Moulding Press	250tonnes	product Size (Max.): - 480 m^2 * 480 m^2 * 80 m^2 (Length * Width *Thick.)
3	Moulding Press – 800	800tonnes	product Size (Max.): - 2000 m^2 * 1000 m^2 * 250 m^2

7.2 Products from the Rubberizing Shop

Figures 8-11 show the products produced at the Rubberizing Shop. The shop has the capacity to produce various types of spare parts and components.

Figure 8: The Masticating (Mixing Mill)

Figure 9: Rubber, seals, and gaskets

Figure 10: Oil Seals

Figure 11: Bushes

8. Power Equipment Repair Shop

The Power Equipment Repair Shop covers a roofed area of approximately 12,500 m². It is equipped with the machinery, instruments, and tools necessary to specialize in repairing various types of motors and power distribution transformers. This shop plays a pivotal role in maintaining operations at ASCL by offering comprehensive repair services. The shop has an installed capacity to repair all types of AC motors (with testing facilities up to 1 MW) and DC motors (with testing facilities up to 200 KW), as well as power distribution transformers (up to 1.6 MVA) with a handling capacity of up to 32 tons.

8.1 Key Features and Capabilities

- Electric Motors and Generators: Repair of various types and sizes of DC and AC motors and generators.
- Power Distribution Transformers: Repair of transformers up to 1.8 MVA. Higher-rated transformers are repaired on-site.
- Other Electrical Components: Repair of electromagnets, control panels, and cubicles.
- Circuit Breakers: Repair of oil circuit breakers and air circuit breakers of various capacities.
- Compressors and Ventilators: Repair of industrial and domestic compressors and ventilators.
- Pump Systems: Repair of pumps, filters, valves, and bearings.

8.2 Equipment

- Dynamic Balancing Machine: Ensures the smooth operation of rotating machinery.
- Air Heating Furnaces & Drying Chambers: Used for various thermal treatments and drying processes.

8.3 Notable Projects

- Repair of electric motors and generators for both internal and external clients.
- Maintenance and repair of power distribution transformers.
- Repair and maintenance of industrial compressors, ventilators, and pump systems.

9. Government Policies

Government policies are critical to repositioning the engineering works complex as an industrial hub for spare parts and components production. Key policies that could support this transformation include:

- Supply Chain Management: Optimization of the supply chain to reduce costs and improve efficiency.
- Industrial Development Policies: Implementation of policies that foster the growth and development of the complex.
- Trade Policies: Negotiation of trade agreements to facilitate the import of raw materials and export of finished products.
- Infrastructure Development: Investment in transportation, energy supply, and communication systems to enhance connectivity and operational efficiency.
- Workforce Development: Training and upskilling programs to enhance workforce expertise in spare parts and components production.
- Research and Development: Funding R&D initiatives and collaborations with academia and industry stakeholders.
- Regulatory Framework: Establishing a favorable regulatory environment to streamline processes and reduce bureaucratic hurdles.
- Investment Incentives: Offering tax holidays, capital allowances, or grants to attract new investors.
- Cluster Development: Promoting the development of industrial clusters to foster collaboration and knowledge sharing.
- Quality Standards: Establishing and enforcing international quality standards for spare parts and components.
- Special Economic Zones (SEZs): Designating the complex as an SEZ to offer additional incentives and benefits for investment.

10. Findings

The engineering works complex of the Ajaokuta Steel Company is well-equipped with the necessary infrastructure and machinery for the production of spare parts and components, supported by a skilled workforce with expertise in engineering and manufacturing. Key findings indicate a growing market demand for these products across various industries, bolstered by the complex's strategic location near transportation networks that facilitate both raw material supply and product distribution.

11. Conclusion and Recommendations

Repositioning the engineering works complex as an industrial hub for spare parts and component production offers significant opportunities for economic growth and development. This initiative will revitalize the existing complex by providing it with a fresh purpose, diversifying its production processes to meet emerging market demands, and transforming it into a centralized hub for production, fostering collaboration, innovation, and economies of scale. It will drive job creation, stimulate local economic development, and promote the efficient use of resources, aligning with sustainable development goals. Furthermore, it will encourage the adoption of new technologies and processes, enhancing innovation and competitiveness. By leveraging the existing infrastructure and expertise, the complex can become a leading supplier of high-quality industrial products, contributing to the growth and development of various industries and the national economy.

The government should make the necessary financial sacrifices and commitments to complete and operationalize the plant, encouraging industrial companies to secure manufacturing orders from the complex. The facilities should be used for training engineers and conducting research. Stakeholders must urge the government to make the plant operational. Investment in the engineering works sector should be prioritized, and the private sector should be incentivized through tax breaks and credit facilities. A comprehensive strategy to address the skills gap through vocational training and apprenticeship programs should be developed. Regulatory frameworks should be streamlined to support sector growth, and urgent funding should be sought to commercialize completed units of the plant. By implementing these recommendations, the engineering works complex can successfully transform into a thriving industrial hub, significantly contributing to economic growth and development.

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