

Assessing the Design Principle and Policy of Production Management in Nigeria. Case Study: Packaging Company

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Abstract

Production management in an industry shapes the foundation of the industry. Proper policies and planning assists organizations are inefficiently converting inputs or raw materials into the required outputs or products. A proper production process also ensures that the products are produced to the specifications required in amounts, demands, and minimum cost. The Plastic and Rubber Manufacturing Industry in Nigeria is an industrial sector that produces and delivers large intermediate products. The production of these vital products like films and packaging materials for the food industry is very significant to the wellbeing of the consumers in Nigeria. The manufacturing industry used as a case study comprises construction, farming, customer products, automotive, and gadgets. This paper assesses the design principle and Policy of production management in Nigeria using a food packaging company as a case study. Due to the increased demand and growth in Nigeria's plastic and rubber manufacturing industry. It gives a detailed explanation of challenges faced by proposed solutions. It concludes on the effectiveness of production due to the present principles and policies being used in Nigeria.

Keywords: Production management, Design principle, Policy, Organization Structure, and Inventory control

1. Introduction

Production management in any organization is the spine of the production process. Production planning helps organizations fulfill their production target. Effective planning facilitates the reservation of all capacity and helps commit accurate delivery time frames to customers. It represents the beating heart of any manufacturing process. Its goal is to minimize time and production costs, effectively organize the use of resources, and optimize efficiency in

the workplace. Production planning incorporates various production items, ranging from day-to-day staff activities to specific delivery times for the customer. With an effective production planning operation for its core, any form of the manufacturing process can exploit its full potential (Vinay V. Panicker, 2018).

Plastic and rubber products are generally called 'polymer' to describe them as a carbon compound with a connected molecular length chain pattern (Chamber et al., 2012). Plastics are primarily organic polymers. The word plastic was created from the Greek plastic phrases that show the ability of materials formed or formed when temperature changes occur. This explains why heat is used in most plastic manufacturing processes when producing plastic products. While thermoplastics are polymers that can melt and be remodeled or recycled, a group of monomers or mixed two or more monomers are used to produce a family of polymers. Large numbers of polymers around us have just been accepted, and some are produced from human activities (Ronkay et al., 2021). Some natural polymers include glucose products which are starch and cellulose. At the same time, rubber and protein each come from isoprene and amino acids. Polymers made by human activities include Teflon, polyurethane, silicon, Lucite, vinyl, epoxy, polyethylene, polyester, boat resin, and nylon. Undoubtedly, polymers have significantly impacted our culture and society and continue to do so (Kehinde et al., 2020).

In Nigeria, plastic and rubber remain a real driving force in the petrochemical industry today, with a possible growth rate higher than 4% per year and low weight. Also, knowing that its constantly increasing mechanical flexibility with heat, corrosion resistance, and thermal properties can be adjusted for user needs. The growth rate of plastic consumption in Nigeria from 2007 to 2020 is presented in Figure 1. These attributes have helped many open markets for these new materials (Dickson, 2018). These new materials include biaxial-oriented polypropylene (BOPP) and cast polypropylene (CPP). The Polypropylene thermoplastic polymers, also known as poly (propene), serve as a good printing surface. It can be made into stickers, labels, textiles, and several plastic components and products (Proponent & Consultant, 2019). CPP, which is not oriented, is a transparent cast polypropylene film that is cost-effective and low density. CPP films have optical clarity, high gloss, good seals power, engine capabilities, and resistance to tears and puncture. These characteristics make this plastic good for the medical industry, food packaging, and textiles the BOPP and CPP is shown in Figures 2a and 2b.

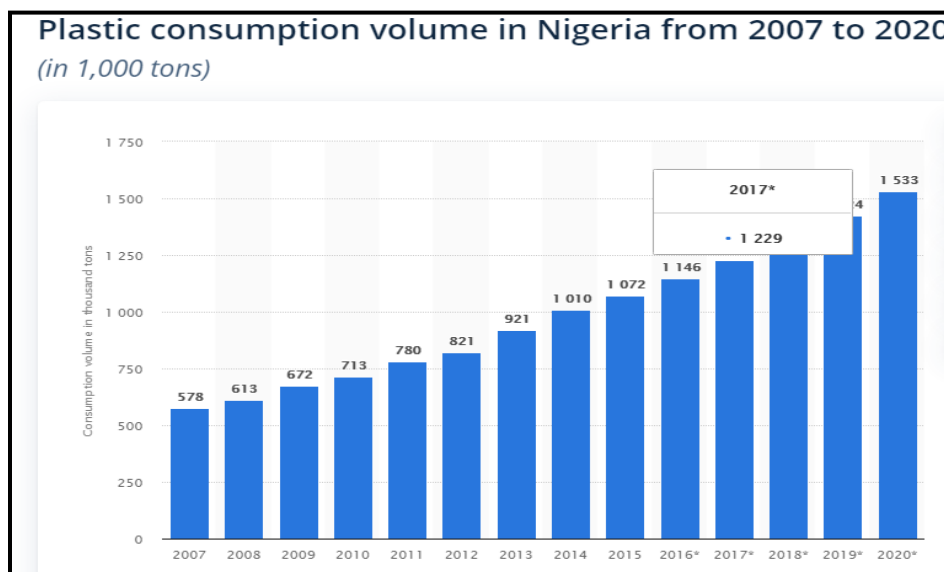


Figure 1. Plastic consumption volume in Nigeria (source: statista.com)

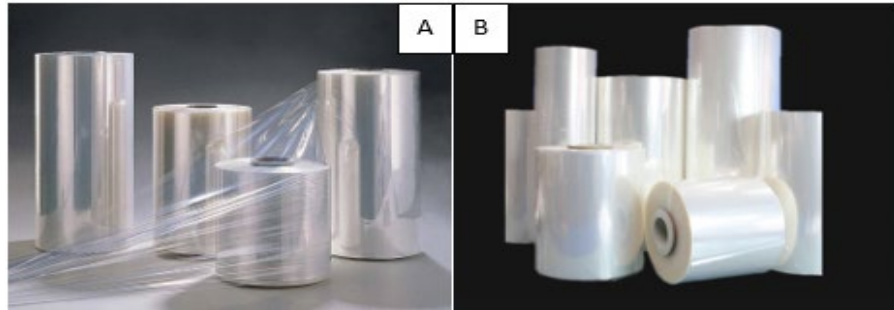


Figure 2. (a) BOPP Sample and (b) CPP Sample

The food packaging company X has taken advantage of this demand and has become one of the leading manufacturers and suppliers of BOPP and CPP films for Africa's laminating and Packaging industry. This paper is written to assess the production management, manufacturing process/production steps, set up of standard facility, principles, and maintenance operation. That further involved the production industry in Nigeria using food packaging company X, which produces BOPP and CPP.

2. Packaging Company: As a Case Study

It was founded in 2005 and began the production of corrugated carton boxes. The flexible packaging arm of the business (BOPP) was introduced in 2011, while CPP production appeared in 2019. Today, it has contributed to Nigeria's industrial growth and manufactures these products to meet consumer needs. The food packaging company X Paper Pulp & Packing Ltd. has advanced mechanical machines and equipment with a yearly production capacity of about 33,000 MT for BOPP and 11,000 MT for the CPP (<https://tempopackaging.com/about/technologies-facilities/>). The factory is fully automated with state-of-the-art equipment that promotes hygiene during production. The facility used for production in Packaging, located at Ota Ogun State, Nigeria, meets the required standard of the Nigerian rubber and plastic industry. Food packaging company X has a packaging facility that is systematically built to allow smooth, efficient production of the BOPP and CPP, as shown in Figure 3. The facility is spacious enough to allow free personnel and materials to ensure safety during production. Conclusion: there is a constant supply of electricity, which gives the facility that aids the firm to produce maximum capacity and meet the demand of its consumers.



Figure 3. Film producing machine and production Layout

3. Design Principle and Policy of Production Management in Manufacturing Industries

The efficient production management industries always provide products needed by the market at the lowest cost possible (Artaya, 2018). Every successful production management solution requires optimal production capacity

utilization to reduce the minimum cost in these industries (Su, 2016). In all cases, the responsibilities in production management are summarized by the "five M's" such as money, men, method, material, and machine. As shown in Figure 4, "Men" are the human elements in the operating system. Because most personnel work physically to produce goods, "People Management" is a significant factor considered in the Nigerian Production management policies (GS, 2014). The machine, the choice of facilities, and the technology used to manufacture these products are planned, and the control methods and procedures for usage are also considered (Welingkar, 2019). The flexibility of the production process and the worker's ability to adapt to machine operations and schedules are also vital areas of concentration in the production phase. Then for material, every production manager designs flow management to ensure the smooth movement of resources and data to meet the requirements in product design and in the process to be used. Lastly, the money management policy is essential for all Nigeria's industrial organizations' proper financing and asset utilization. However, any industry that allows excess inventories to build up to achieve high-level production and steady operation. Sacrificing good customer service and on-time delivery runs a risk of overinvestment. Also, high current costs wipe out any temporary competitive advantage that might have been obtained during the production process and service delivery to consumers (Ibrahim and Council, 2016).

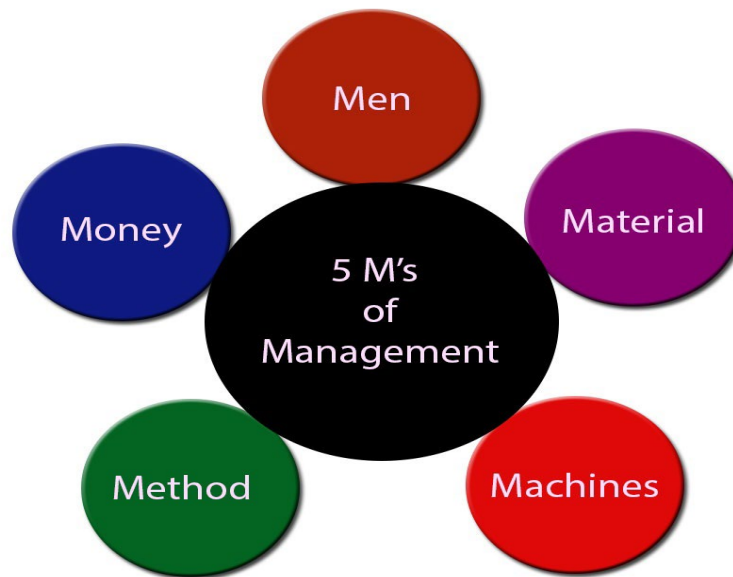


Figure 4. The five M's of management

3.1 Organization Structure

The organizational structure of any business is a system used to define its hierarchy. In this system, the employee's position is identified, including their function and those they report within the company (Ebele et al., 2015). It is the systematic structure of a company or organization. It includes the relationships between the directors, managers, and employees. The organizational structure, which can also be referred to as the hierarchy, establishes how an entity operates and helps the organization achieve its objectives and goals. An organizational structure in the Nigerian industries describes how tasks allocation, supervision, and coordination are directed to their objectives. It also serves as a perspective through which employees can see their organization and surroundings (Nwonu et al., 2017).

3.2 Production system

The production system is described as the collection of people, equipment, and procedures required for a Company's manufacturing operations (or other organization) (GS, 2014). The type of production system adopted in the Nigerian industries is the mass production and continuous production system, where Industrial parts or discrete assemblies are produced in large volumes. Furthermore, its facilities are organized according to the sequence of the first operations to the final product. (Georgiadis et al., 2021; Samuel et al., 2019). Items are made to flow through a sequence of operations by material handling devices, such as conveyors transfer devices (Shekari et al., 2021; Okokpujie et al., 2018). The machine is set in a product layout type of arrangement. The product and the standardization of the process exist, with all the outputs following the same path.

The production system in these industries is marked with

- Standardization of products sequences process.
- A special-purpose machine that has a high production capacity and level of production,
- The significant volume of products,
- The shorter cycle of production time,
- Inventory of lower processes,
- A balanced production line,
- The flow of material, component, and continuous section and without follow-up,
- An easy production planning and control, and
- Material handling can be fully automated.

3.3 Inventory Management

A crucial step in managing production is inventory control (Shenoy et al., 2018). An inventory includes raw materials, parts, work in progress, finished products, packaging materials, Packaging, and general supplies. There is a need for the efficient use of financial resources and available materials for proper production management. Many manufacturing companies with significant inventories generally hold stock managers responsible for stocks (Costello & Costello, 2017; Okonkwo et al., 2019). The management of a successful inventory generally solves the problem of which items are to be transported in various locations at the right time, ensuring a successful production of the finished goods. Hence, a company's success (Shenoy et al., 2018; Okokpujie et al., 2019). Delays in receiving the necessary parts or supplies can cause considerable losses in capital and cause an accumulation of unusable action. In today's industries, such as in our case study, managers depend on mathematical models and computer software developed by software engineers, industrial programmers, and operations researchers to properly manage their stock control problems (Sabure, 2020; Akinlabi 2021; Ezekiel-Zebulon et al., 2020).

3.4 Plant Layout

Plant layout shows the best possible way to arrange an industrial facility: machines, processing equipment, and the administrative department to maximize productivity and minimize losses caused by disruption during production (Tripathi, 2020). Although plant layout varies, the efficiency of future plant operations depends on how well the plant layout was developed. The provision of a plant layout helps determine the location of the department and production points and the proximity between them (Chikwendu, 2016). A plant layout allows proper utilization of the available spaces. It describes the direction of flow in the factory and the distances covered by materials and personnel. The ongoing work and works waiting for further processing are also affected (Welingkar, 2019). Figure 5 shows the type of plant layout used in the film and packaging industry, such as in the case study.

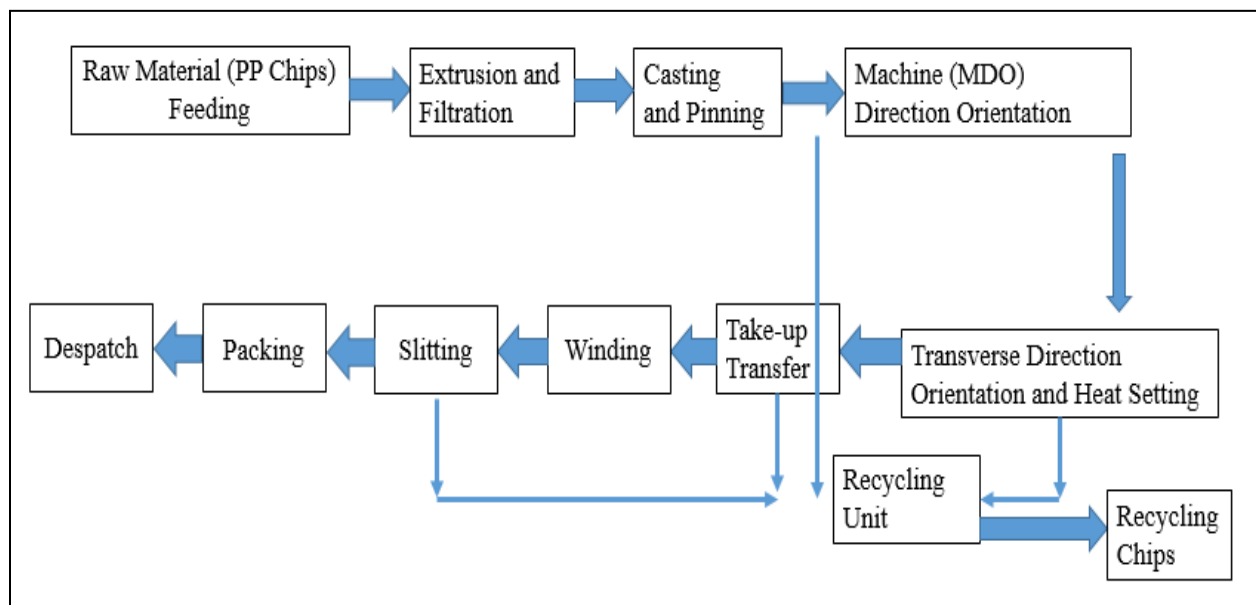


Figure 5. BOPP Manufacturing Process flow diagram (Proponent & Consultant, 2019)

4. Assessing the Policy and Principles in Film Production in Nigeria

In the film production industries such as in Food Packaging Ltd, the central production management policies and principles followed are:

- The specification and purchase of the right equipment and raw materials (polypropylene chip (PP chip)) polymer, proper selection of skilled workers, plant location, and cost estimation,
- Proper analysis of specifications and design of the BOPP and CPP product according to the customer's need to determine the production process. In transforming the polypropylene chip (PP chip) to the desired products,
- The supervision and control of the process of transformation for effective production of goods and services

Figure 6 shows the practical steps of production management when assessing the design principle and Policy of the food packaging industry.

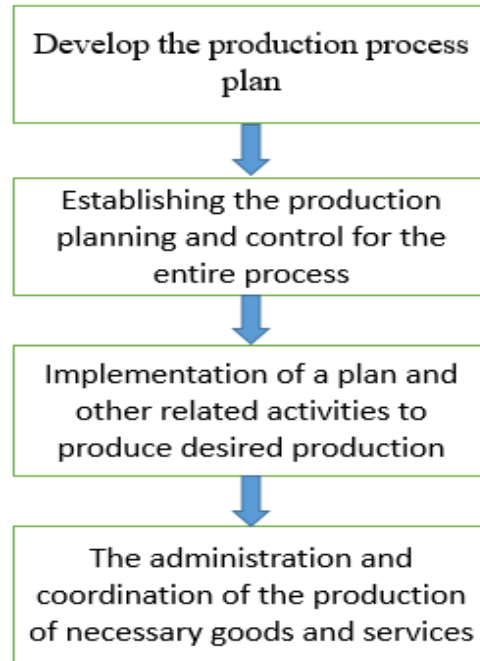


Figure 6. Steps for effective production management

Some Main Principles of Production Management followed by film manufacturing industries, such as in our case study are.

- i. Shorter Setup times: Long configuration processes cause waste; it ties the work, and the equipment adds no value. Proper training, improving efficiency, and holding workers responsible for their configuration setup time has enabled production industry such as Tempo to reduce their configuration times (GISSELLA, 2016).
- ii. Small-scale production: Cutting the cost and time dedicated to the setup configurations has allowed companies to produce goods in smaller lots depending on demand. This brings about a lower setup, lower capital, and energy (Ikon & Chukwu, 2018).
- iii. Empowering employees: When Industries divide a small team workforce and give them the responsibility for housekeeping and several other tasks, it has improved efficiency. Few teams are assigned from leaders and workers. They are trained in maintenance issues, which allows them to immediately deal with delays in the production process (Sievers et al., 2021).
- iv. Equipment maintenance: The line workers are better placed to deal with mechanical defects and subsequent repairs. They can respond to problems quickly and frequently without supervision, allowing the production process to restart faster after closing (Tijani et al., 2016).
- v. Pull production: By minimizing inventory/stock retention costs and production times, film industries base the number of materials, workforce, and utilized energy at each stage of the product demand process. Production step. This is called just in time (JIT). Its principal aims to produce goods based on demand at any time, eliminating unnecessary costs (Ortikmirzaevich, 2017)

4.1 Manufacturing Process

The manufacturing process is the steps taken throughout the transformation of raw material to a finished product. The manufacturing process begins with product design and material specifications from which products are manufactured. These materials are then modified by manufacturing the process to the desired part. (Rane & Kanny, 2018; Akinlabi et al., 2019).

The polypropylene chip (PP chip) is accepted in granular form in the manufacturing process at tempo packaging. It is extruded in the extrusion process at a temperature around 250 ° C and then filtered. After filtration, it is thrown through a die and cooled to provide a solid sheet shape. This cast sheet is then stretched longitudinal at the temperature range of 90-140 ° C in MDO (Machine Direction Orienter). Transverse Direction Orienter(TDO) stretch films with moving chains. Hot settings are also carried out in the TDO. The temperature in the TDO is in the range of 150-215 ° C during the manufacturing process. Edge trim is removed at the Take-up transfer unit. A Jumbo roll of BOPP (Bi-axially Oriented Poly Propylene) film is formed. This jumbo roll is finally cut according to the customer's required size. Finally, the film is packed and sent. The recyclable waste from different processes is recycled in a recycling unit, and recycled chips out of this unit can be reused along with the normal virgin Polypropylene (PP) Chips. (Proponent & Consultant, 2019).

4.2 Maintenance Schedule of the Entire Process

The maintenance schedule is essential for running an efficient and effective plant factory. The main objectives are to eliminate disruption of service that can occur as a result of equipment failure and prolong the equipment's lifespan (Tayal et al., 2021). There are two types of maintenance: preventive or corrective maintenance; however, in production BOPP and CPP (films), an effective maintenance program is divided into four, namely, an emergency maintenance plan, program evaluation, preventive, and a general maintenance plan. The maintenance culture at the packaging company is recommended for other companies as they keep their equipment running at optimal conditions. As a result, the company has successfully served their customers better, optimally making use of their equipment for an extended period and efficiently making good use of resources.

5. Challenges Faced in the Film Production Industry during Manufacturing Process

The main challenges of the production policy based on a few literature reviews are:

- a) The availability of resources: specific resources are needed to be made available such as:
 - The location
 - The plant and machines
 - Human work/ skills policy
 - Finance
 - Energy supply

This challenge always posed a problem in achieving sustainable production process in the industry (Su, 2016)

- b) Production level: The production level must be determined by the application level and the unit cost. The manufacturer must be careful not to produce at a unit price that will be unprofitable (Chete et al., 2017).
- c) Cost and price: A proper relationship between the cost and the price should exist. The change of application or the decrease in purchasing power can reduce the price. The increase in cost eventually increases the price. The cost can be affected by the labor demand, raised wages, government policy, energy availability, and raw materials (Macroeconomic, 2021).
- d) Finance: Money is needed to finance a business until profitability is reached (Afolabi & Laseinde, 2019; Akinlabi et al., 2019).
- e) The expertise of management: Management must ensure that it has the capacity and ability to deal with new challenges. Adequate techniques and equipment should be available (Fayomi et al., 2019)
- f) Waste management (Ronkay et al., 2021)
- g) Waiting time (Onwughalu, Onyinye, Okeke, K.E, Henry-Chibor, 2017).

However, most industrial companies do not have established Policy that governs the production process. Therefore, it is the sole right of the Government to put a specific instruction that all manufacturing companies should develop and implement standard Policies in operation (Okokpujie et al., 2020).

6. Way Forward and Recommendations

- Production organizations should see the organizational structure as the main requirement for good performance, and non-performing companies should redesign their structure for better performance.
- Adaption and flexibility should be in place to enable employees to put in their best and meet the needs of the situation or environment.
- There must be training and development, and there must be strategies put in place to affect training and development for any organization to move forward
- It is strongly recommended that individuals and corporate organizations benefit from plastic recycling merits while researching the topic.
- The petrochemical sector should be developed. This will promote the production of pulping chemicals.
- The qualified human capital that provides distinctive superiority
- Lean manufacturing should be adopted across industries to reduce waiting time(Yang et al., 2015)
- More government investment as capital is a significant factor in these industries
- Efficient marketing and communication strategies
- Quality control should be carried out more frequently because of the sensitivity of the product to ensure good quality of products(SULE, 2017)

7. Conclusion

Good production management policies and principles have helped achieve the long-term success of production industries in Nigeria. Plastic and rubber manufacturing industries use well-tailored and properly planned production systems. However, there is a need for legal policy development from the Government of Nigeria to oversee operational management in the packaging industry. Also, the need for the strategic development of this sector because of its importance to life and environmental pollution. This should be done through a deliberate policy to encourage the production of films locally. This paper has assessed and shown the effect of design principles and production management policies on an organization's performance in Nigeria. The results indicate that production management determines performance. Without an appropriate structure in place, the organization has a high chance of failure.

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