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The Application of the Theories of Operations Management within Africa (Nigeria)

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Abstract:

This paper seeks to intensely look at the branch of management theories that addresses the improvement of overall productivity which is operations management. The purpose of this paper seeks to review how operations management theories are applied and the methodology used is qualitative methodology. This paper also critically looked at the theoretical perspective of operations management and finally came to the conclusion that every organization be it manufacturing, production or services, implements operations management and therefore recommends that for organizations to continue to be in business, they must apply operations management to their everyday business activities.

Keywords: Operations management, production, services, organizations, methodology

1. Introduction

Operations management is a part of management theory that deals with the design and control of the production process and looks into the redesign of organizations operations while producing goods and rendering of services (Chase R.B., Jacobs F.R., & Aquilano N., 2007). It is also involved with the responsibility of ensuring businesses operates efficiently by using as few resources as necessary and effectively so as to achieve customer satisfaction.

The field, expertise or function that deals with managing the manufacturing, production and the delivery of an organizations products and services in terms of the functions of management like planning, organizing and supervising is termed Operations Management or OM. Operations management is used in so many ways, it can be used in quantitative techniques of forecasting, it can also be used to analyze inventory, as well as statistical quality control methods, and can also be used for networking models etc. that deals with management inventory, planning, designing of the process of production, the purchasing of raw materials, storage and selling of the final goods or services and likely areas in manufacturing sector.

The entire production or services of an organization be it manufacturing, producing or rendering of services, rely heavily on operations management because it systematically transforms inputs which are (customers, raw materials, labour, energy, etc.) to output that is (goods and services for the consumers). In a nutshell, it includes production, quality management, rendering of services that cuts across sectors like hospitals, banks, companies that works with suppliers, customers and the use of technology. One of the main functions in an organization is operations management according to Chase R. B. *et al* (2007), as well as, human resources, supply chains, finance and marketing,; and all these inculcates the management of producing goods and services daily, strategically and still remain in business and compete effectively and effectively and to achieve all round organizational productivity. In other words, operations management by Krajewski, L.J., Ritzman, L.P. and Malhorta, M.J. (2013), includes decisions that has to do with operating strategically, production design, quality management, control of inventory, the process of designing, capacity abilities, and facilities planning, as well as production planning, which invariable leads to organizational productivity.

In the year 5000 B.C., Production and operation systems is said to have begun when the Sumerian priests started the old ways of recording events, like taking of loans, also keeping of tax records, and other transactions. Also, in 4000 B.C., the application of operation systems was seen to have taken place because during this period, the Egyptians started applying the functions of management which are planning function, organizing function, and control function in massive projects like the building of the famous pyramids. In 1100 B.C., it was discovered that the Chinese has specialized labor; and around 370 B.C., Xenophon talked about the merits of dividing the different activities that is vital for making goods like shoes for all kinds of people in ancient Greece, (Fredrick Klemm, 1959).

Before the great industrial revolution that saw people move from the farms to the city, and moving from working with their hands to working with machines, it was a known fact that jobs were solely using two systems described as the homemade system and craft guilds. The homemade system saw workers taking their materials to various houses where the work is done, and for the craft guilds, work is moved from one shop to shop, a good example can be seen in shoe making, where a tanner tans the leather and then it is given to curriers where it is then finally moved to the shoemakers and saddlers.

The great industrial revolution brought about great changes that affected both the manufacturing and mining world and has today spilled over to affect other sectors, changes like moving from craft (working with hands), to working with machines, hand-made to machine-based manufacturing and unit production to producing in large quantities.

In 1903, the founder of the Ford Motor Company (Henry Ford) was the first to introduce the assembly line concept in his factory. In Highland Park (1913), the concept of the assembly line that paved way for goods being produced in large quantity was done by Henry Ford.

2. Purpose of the Study

The aim of this study is to critically look at the application of the theories of operations management within Africa (Nigeria).

3. Literature Review

Operations management laid its foundation on Fredrick Winslow Taylor's scientific management thought (1896), or Taylorism as its popularly called, because it looked at what Taylor described as 'the differential piece-rate system' where a lot of tests, as well as measurements and the formulation of formulas that deals with the cutting of metals as well as manual labour (Taylor, 1906). The introduction of the stopwatch that accurately measured time that performed each single task of a complicated job, was also by Frederick in 1883. It was he also that talked about how productivity can be studied scientifically as well as specifying how to align the various tasks to do away with the wastage of time and in so doing, work quality is enhanced.

The concept of work sampling and predetermined motion time systems (PMTS), came about by the popular husband and wife Frank B. and Lillian M. Gilbreth in 1912. This concept has to do with randomly measuring work sample variable that occurs each time a task is done. Predetermined motion time systems allows the usage of standardized predetermined tables of the tiniest body movements (e.g. turning the left wrist by 90°), and inculcating them to forecast the time that is required to do a simple task. PMTS has gained prominence solely because it can forecast work measurements without actually observing the real work. The Gilbreths made substantial headway in the branch that has to do with motion study and laid the entire grounds for modern applications of simplification of work, jobs that are meaningful and also lucrative wage reward plans. Frank and Lillian Gilbreths were able to take motion pictures at certain time intervals while the operators were actually acting the said task. It should be noted that Taylor's stop watch time study and the Gilbreth's motion study, combined together became what is famously called the time and motion study, and the concept is all about the standard method and standard time; and the flow process chart was propagated in 1912 by Frank Gilbreth.

Notable authors also mentioned in this field are Ford who in 1913 made a publication on 'How many parts to make at once' this paper contained his thoughts on 'the economic order quantity model', wherein Whitman talked about the following problems:

'The capital interest which is linked to wages, material as well as overhead sets a maximum limit to the quantity of parts which can be profitably manufactured at one time; 'setup costs' on the job fix the minimum. Experience has shown managers a way to determine the economical size of lots'

Whitman's publication motivated other authors in the field of mathematical to focus on the root cause arising from production planning and inventory control. One of such authors is Walter Shewhart who in 1924 while working at Bell Labs propagated the control chart by using technical memorandum. Pivotal to this method was the clarity between common cause and special cause of variation. Shewhart in 1931 in his published paper 'Economic Control of Quality of Manufactured Product', is actually the first that talked about the systematic treatment of the subject of Statistical Process Control (SPC).

Methods-time measurement (MTM) in the 1940s was developed by H. B. Maynard, J. L. Schwab with G. J. Stegemerten. It became the first of numerous predetermined motion time systems. It was said to be predetermined because the estimation of time cannot be ascertained in loco but are actually gotten from an industry standard. It was actually illustrated in 1948 by the authors in a published book they named 'Method-Time Measurement'. The Colossus which was the first computer that was programmable electronically and digitally was invented by Kantorovich in 1939 during World War II, and it was invented to address mathematical problems computationally and to also solve large linear programming equations. Around this time too, saw the wide usage of Total Quality Management (TQM) in Japan, which proponents are the American authors of Edward W. Deming, Joseph M. Juran and Armand V. Feigenbaum. The total quality management is a vital tool that is used to implement and manage quality that leads to improving organizational performance and it's done continuously. The total quality management of any organization has to do with participation, work ethics, focusing on customer needs. Total quality control also has to do with supplier quality improvement as well as integrating quality system with aims and goals of the organization.

4. Theories of Operations Management

The theories of operations management have evolved over the years and they are as follows;

4.1. Business Process Re-Engineering (Bpr)

In 1993, this was brought about by Michael Hammer. It is a strategy that every organization focuses on by analyzing and designing the flow of work along with all its processes that goes on in organization. The purpose of the business process re-engineering is to make sure that organizations drastically restructure their companies by relying on the ground-up design of their organizations processes.

4.2. Lean System

This is a concept that talks about eliminating of wastage ('Muda') in a manufacturing organization or service sector. The lean system also deals with waste that is generated through overburden ('Muri') and those produced through unevenness in workloads ('Mura'). The word lean manufacturing was propagated in the book 'The Machine that Changed the World' in 1990 by Womac Jones Roos. Over the years, lean systems have been vastly applied.

4.3. Six Sigma (6σ)

This is a theory that deals with quality in 1985-1987 first practiced at Motorola company. The term 'six sigma' comes from statistics and is used in statistical quality control, which evaluates process capability. It is a set of techniques and tools for processing and improving quality in products and services, and in 1986 while working at Motorola, Bill Smith an American engineer introduced the six sigma, while in 1995, in General Electric, Jack Welch made it popular by making it central to his business strategy. A six-sigma process is one in which 99.99966% of all opportunities to produce some feature of a part are statistically expected to be free of defects. It then means in simple terms that Six Sigma refers to control limits placed at six (6) standard deviations from the mean of a normal distribution that became very famous after Jack Welch of General Electric launched a company-wide initiative in 1995 to adopt this set of methods to all manufacturing, service and administrative processes. More recently, Six Sigma has included DMAIC which stands for Define Measure Analyze Improve Control (for improving processes) and DFSS which means Define for Six Sigma And can also be called DMADV Which stands for Define Measure Analyze Design Verify (for designing new products and new processes). Six Sigma helps to reduce costs and improve quality (*De Feo, J. A. & Barnard, W. 2005*).

4.4. Reconfigurable Manufacturing Systems

This theory is all about production. It is aimed at quickly modifying the structure, hardware as well as the software parts, so as to be able to adjust the functions and capacity of the production process within a part family arising from erratic market changes or intrinsic system change (Koren, Y., Jovane, F., Heisel, U., Moriwaki, T., Pritschow G., Ulsoy G., & Van Brussel H., 1999). RMS has six characteristics which are:

- Convertibility: this talks about how easy it is to functionally transform a system that is already in existence as well as machines that corresponds to recent requirements of production.
- Scalability: talks about how easy it is for production capacity to be modified. And this is done either by the addition or subtraction of manufacturing resources, and or how easy for the components of a system to change.
- Modularity: this has to do with how to compartmentalize all operations so as to function in units and can be easily maneuvered between different production lines so as to bring about optimal organizational performance.
- Integrity: this is all about how well it is to put modules quickly, accurately by using mechanical, control with information to quicken integration and communication.
- Customization: this talks on the production of a certain product arising from customers requirement, design, configuration and specification, which invariably leads to customer satisfaction.
- Diagnostability: the ease to quickly ascertain the present condition of a system and be able to know, diagnose and pin point the actual problem of a defective product output so as to be able to immediately correct the defect.

4.5. Project Production Management

This theory deals with analytically applying tools and techniques developed for operations management, as described in Factory Physics to the activities within major capital projects such as encountered in oil and gas and civil infrastructure delivery. The knowledge that forms the basis of PPM originated in the discipline of industrial engineering during the Industrial Revolution. During this time, industrial engineering matured and then found application in many areas such as military planning and logistics for both the First and Second World Wars and manufacturing systems. As a coherent body of knowledge began to form, industrial engineering evolved into various scientific disciplines including operations research, operations management and queuing theory, amongst other areas of focus. Project Production Management (PPM) is the application of this body of knowledge to the delivery of capital projects. Project production management can then be described as the application of processes, methods, skills, knowledge and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters. Project management has final deliverables that are constrained to a finite timescale and budget. But it should be noted that PPM is not seen as an operations management theory because operations is something that is a continuous process but PPM has a beginning (when the project starts) and an end (when the project is completed).

5. Applications of Theories of Management

5.1. Business Process Reengineering

This theory deals with how radical changes are made in an organization to obtain drastic and positive change in the performance of service, price, quality, and speed. This theory is the analyzing and redesigning of organizations activities. An example of this theory is that of a fast food company like Chicken Republic, Peperoni, Kilimanjaro etc. and restaurants like Hotel Presidential, Eastern Garden, Asian Town etc., that have completely redesigned the delivery of

products and has led to surprising outcomes. Taking fast food / restaurant as an example, the activities goes like all others, the customer places his or her order, the request is sent to the kitchen, where the order is prepared by the cook, and the meal is then delivered to the consumer by the sales person, making the work time less and faster, which makes the fast food / restaurant to serve the customers in record time. Another good example of BPR, is that of cereal factory, like corn flakes made by Nestle foods, corns are gotten from the farms and transported to the factories for production of corn flakes cereal, in order to eliminate wastage of time, the factories are built close to the farms, so the corn is harvested from the farm and is moved straight to the factory for the production of cereal (corn flakes).

5.2. Lean System

Every company tries implementing and incorporating so many managing and manufacturing styles into their business activities. Although there exists so many ways and techniques in achieving this, it is guided by some principles that all manufacturing organizations adhere to. It should be noted that the lean system was first adopted by TOYOTA Company. The car giant perhaps was the first to apply the lean system in their manufacturing of their product, where it was first called the 'Toyota Production System (TPS)'. They not only eliminated waste, but in the process perfected the know-how needed to lessen defective goods that are not wanted by the customer. The company adheres to two core systems that enables them achieve their desired goals. One is known as Jidoka (automation), and it basically means 'mechanization with the help of humans.' It basically boils down to though some parts of the job are operated with machines, human element is required to always check product quality standard. Also, the machine can easily shut down when a defect is detected; this is made possible due to the programs built into the system. The other core system adhered to is that termed the 'Just in Time or JIT model'. It basically means that the next action of an activity can start only when the previous process has been achieved, in so doing, eliminating any flaw in the assembly line, and preventing the production of unnecessary work. This system has given rise to how lots of other organizations have toed the line in the manufacturing of goods.

A good example of a manufacturing company that has applied this system is the cement factory like Dangote cement, Eagle cement which is now known as Ebeto Cement. Another good example is that of the Nigeria Bottling Company that produces both Coca Cola soft drinks and Eva water amongst other products. Once a defect is detected, the machine shuts down, if the operator (human element) has not been able to remove the defected product on time. The lean system has made these companies to be automated thereby detecting and checking for flawed goods in as much as a short period of time; meaning more goods can be supplied to the end user for a price that is cheap. These two core systems are applied to monitor production of goods so as to do away with not producing more than is required as well as eliminating wastage of valuable materials in the process.

5.3. Project Production Management (PPM)

In 2016, Arbulu, R. J., Choo, H. J., and Williams M., defined this theory, as a theory that deals with how the projects that are capital in nature are done. According to Shenoy, R. G. and Zabelle, T. R. (2016), the PPM framework is based on a project as a production, which can easily transform raw materials like information, labor, plant and machinery into usable goods and services. This theory is therefore the management of coordinating every aspect of a said project. Example is a new strategy that is launched by a marketing organization, as well as that of a new product. Examples of project production management that has to do with manufacturing are: cars (Innoson motors), houses (Rivers State low cost housing), judges quarters built by the Rivers State government, flyovers, air ports, dams etc. examples of services are retailing like everyday supermarket, well-done supermarket, banking (uba, Zenith etc.), government agencies like Rivers State Signage Agency (RISSA), health care like Braithwaite Memorial Specialist Hospital (BMSH) etc., utilities like Holding Electrical Distributors (PHED), telecommunications like, Globacom, MTN, Airtel etc. Others are constructing bridges, building of houses and the development software that improves business activities. Palliative efforts caused by natural disaster like Federal Emergency Management Agency (FERMA), strategically breaking into a new geographic market are all seen as projects.

Completing a project as at when due, requires a lot of man agent skills, not going over budget, making sure deadlines are met as well as sticking to quality. This theory then is how skills, wit, experience and tact are applied, to make

5.4. Sixsigma

This is one of the most rigorous approach that is highly effective when implementing and checking for quality as well as checking for techniques that deals with improvement in the organizations activities by accelerating each part of the organization. Six Sigma deals with the statistical as well as the analytical ways to reducing the variation in the finished goods by inculcating segments from the theories of many known authors. The aim of this theory is to make every companies activity error free. Six Sigma helps one understand the basics and merits of the different ways used for its implementation (Kwak, Young Hoon & Anbari, Frank T., 2006). The strategy of Six Sigma is to enhance the value of the end product by knowing and eliminating the problems of flawed goods and decreasing the effect of variability when producing these goods. Six Sigma is applied to decrease the cycle time, reduction of pollutants, and reduction in cost, promote customer fulfillment, and in so doing, increase profits and enhance organizational performance. Using service sector and supply chain as an example, companies that apply six sigma are: Jumia, OLX, Amazon, DHL, this is to ensure that goods are sent to customers timely while preserving the integrity and quality standards from start to finish of the supply chain. This theory ensures that goods are not defective and so guarantees that goods are delivered on time, and these are the main functions of a supply chain, Dasgupta Tirthankar (2003).

The main purpose of this theory is to improve the value (by reducing wastage). The theory is all about how companies can produce goods and services in a better, quicker and cheaper manner. The theory also harps on how customer loyalty can be made better, by eradicating errors or at least bringing it down to its least minimum, improvement of cycle times as well as the reduction in costs by eradicating activities that do not add value to the product, like LG the electronics company, seeing that Nigeria has power problems, decided to manufacture equipment that run on inverter and solar like air conditioners, fridges etc. It is pertinent to note that companies that have implemented Six Sigma perform better.

5.5. Reconfigurable Manufacturing System

This is an ideal concept that consists of six core reconfigurable manufacturing system. The basic parts are: modularity, integrability, customized flexibility, scalability, convertibility, and diagnosability. Every aspect of this theory has these basic parts, although some has it more than others. This theory is all about how fast and quick it is to adapt to unforeseen happenings like faulty machines and the unstable nature of the market economy. This theory quickens the launch of new goods and gives room for adjustment of more goods to be produced if and when required. A normal reconfigurable system allows for the production and adjustment to be made if and when needed (Mehrabi, M. Ulsoy, G. and Koren Y). RMS is applied using the modularity and integrability in the coal mining machines, in the screening of machines of different sizes, modularity and scalability is used, whereas convertibility is used in portable underground mining machines of single or multiple drilling bits

6. Methodology

This paper used the qualitative, narrative method of the interpretivist approach to analyze the application of operations management. Rieder in 1985, described this method as seeking in understand problems by observing and interviewing respondents, not so for the positivists method that sees the existence of objective reality and facts to be tested using methods that can be researched and verified. For Roth and Mehta (2002), they see the narrative method as a method that tries to comprehend phenomena through the eyes of the observer instead of using scientific standards of verification which is done through testing.

This paper depended solely on secondary sources of data collection. The secondary sources of data are mainly historical information recorded by others through journals, relevant text books on production management and its application etc. The secondary source of data collection was used because it's a less expensive mode of collecting data, this is so because it was not mandatory to meet with respondent's face to face (Ember & Levinson, 1991).

7. Findings

The theories of operations management encompass a variety of responsibilities. One of such varied responsibilities is to make sure that the organization efficiently performs, either by using the littlest amount of raw materials possible to meet customers' needs to the greatest economical standard. The decisions are strategic and have long-term implications and are usually expensive and resource applied must be carried out to the last dime. Every organization, be it production, manufacturing, or in the service sector, all indulge in operations management because it is the live wire or live engine of every organization, where strategic important decisions are taken and then implemented. Every organization seeks customer satisfaction and retention, and so constantly re-invents itself by applying operations management to its everyday-to-day business activities.

8. Conclusion

The transformation of raw materials to useable output that gives the end user their desired wants can be referred to as Operations management; and it is practiced and or applied by every type of organization and even in our everyday routine life. It has to do with every sector of production from inspiration to implementation. It deals with the 'who, what, where, when and why' that deals with every finished product and services that is provided. Operations management is a set of theories that organizations undertake to efficiently increase production. To control production and delivery of an organization's products and services by planning, organizing and supervising, operations management is used to enhance efficiency and organizational performance. The operations functions as we can see is concerned with strategically on a daily basis produce usable products that lead to efficiency effectiveness and organizational productivity and performance. Operations management encompasses configuration, service operations, mathematical modeling, safety, and risk and maintenance management.

9. Recommendations

- Every organization should endeavor to strategically increase efficiency in operations and production to boost productivity.
- Every organization intending to operate efficiently, should try to use minimum raw materials needed as well as strive for customer satisfaction keeping in mind to maintain the highest possible standard.
- Organizations should try and maximize resources by managing and making sure that raw materials and labor are used judiciously to create final goods and services.
- Organizations must take decisions and these decisions can be long- term or short-term decisions and should reflect the stance of the company, in its capability and culture in the production of products that provide essential value to the end user.

- An organizations long term survival is immensely enhanced if and only if the company has made excellent operational strategic decisions while designing and executing its transformation system to meet the ever-changing wants of its yearning customers.
- Operation is a major strategic function of any company, making it a crucial aspect and the live wire of how the company goes about obtaining, accomplishing and achieving the company's strategy and making sure it survives in the long-term. So, for any organization that wants to continue to strive, compete, make profit and remain in business, it must indulge in operations management for maximum efficiency, effectiveness and all-round performance.

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