Production Control and Operational Efficiency of Food and Beverage Firms in Akwa Ibom State

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Abstract: This study examined the influence of production control on operational efficiency of food and beverage firms in Akwa Ibom State. The aim of the study was to determine the relationship between production control on operational efficiency of food and beverage firms. The study employed the theory of Constraints by (Eli Goldratt, 1984). The study adopted the survey research design. Based on the research questions, a structured questionnaire was administered to 321 respondents comprising (management staff of food and beverage firms). A total of 302 copies of the distributed questionnaire were retrieved and utilized. These copies were analyzed and the hypotheses were tested using the Spearman Rank Order Correlation analytical tool via the SPSS package (version 21.0). Findings revealed a significant relationship between inventory management and operational efficiency. Also; there was a significant relationship between quality control and operational efficiency of food and beverage firms. The study concluded that effective inventory management via stock availability, inventory accuracy, and capacity utilization would optimize operational efficinecy. The study recommended amongst others that food and beverage firms can benefit greatly by adopting an integrated inventory management system that tracks and manages inventory levels in real-time the organization should implement a robust quality control system that involves establishing standard operating procedures (SOPs) for quality checks, inspections, and testing at various stages of the production process.

Keywords: Production Control, Operational Efficiency, Inventory Management System, Quality Control.

Introduction

The production systems of various industries have increasingly become a strategic business management function that drives differentiation and competitive edge and thus, the propellers of growth in the world's economies. Accounting for about 5 percent of gross domestic product, 10 percent of total employment, 10 percent of US consumers' disposable personal income (DPI), total sales of $1.4 trillion, nearly 27,000 establishments employing 1.46 million workers and also ensuring adequate, secure food supplies; food system sustainability; and nutritious diets (Committee for Economic Development (CED), 2017), the food and beverage industry revitalizes a buoyant US economy. Similar to this, the textile, food and beverage, iron and steel, and other industries are practically the hubs of production technology innovation and the source of job possibilities in countries like Japan, Singapore, Indonesia, Malaysia, Taiwan, and China (Mwang'onda et al., 2018). Due to these industrial dynamics and complexities, it is unquestionably necessary to increase the skills of the manufacturing workers (Makhado and Sukdeo, 2018). To this end, companies in the manufacturing industry value effective and efficient management of

their production plant operations in a manner that optimizes production cost, inventory use, production quality and profitability.

This is because of the increase in customer demand and the present level of competitiveness in the Nigerian business environment, the majority of manufacturing enterprises in Nigeria designed essential strategies to fulfill the demands of consumers. The efficacy and workability of their creation, planning and management in the manufacturing process determine how well these strategies were implemented. Production planning and control are one of the most crucial aspects of production management; in fact, they are the manufacturing company's nervous system. It is critical in a manufacturing organisation ensuring production is carried out as efficiently and affordably as feasible, and that the products produced are of the right standard and delivered on schedule. Only careful production planning can achieve this. However, just planning production will not fix the problem production management, because production plans don't take immediate effect and don't operate on their own. To accomplish this, the production manager must make conscious efforts; such as regulating work assignments, reviewing work progress, and devising techniques to create consistency between real and planned performance, so that the plans are carefully followed and the standards established during the planning stage are maintained. This is when production control enters the picture.

Simply said, production planning entails choosing which resources to employ and how to apply them to produce a product (good or service) in the future; whereas production control is the regulation of the production system to achieve objectives as quickly as feasible. Material forecasting, scheduled order processing, long-term management, and infrastructure development are also embedded in production planning (Guo, Zhang, Chen, et al., 2019). Production control entails keeping a watch on the production line and interfering when things are not going according to plans. A longer temporal assessment of production preparation is essential to capitalize on production runs. Production control employs a number of control approaches to meet output objectives and guarantee that the manufacturing process operates at peak efficiency. Production planning and control in industrial companies is an approach that comprises the conversion of raw materials or components into finished products, as well as the optimal combination of these components to minimise defects and maximise profit.

When a business has operational production planning and control operating systems, it is very simple to guarantee an affordable manufacturing operation, encourage timely product delivery, cut down on total time, please customers, oversee production with other components, and make sure that the right man is given the best tasks (Bashir, 2020). Production planning and controlling (PPC) not only provides an overall approach to the production unit but also oversees and regulates every stage of the workplace; collecting feedback from the engineering and product/process design departments (Wickramasinghe, 2016). It is impossible to overstate the significance of production planning and control in the manufacturing industry, yet a number of hindering factors prevent it from operating at its best. After-sales service, seasonal fluctuations, order wastage and production, lack of current automation equipment for correct computation, market, and losses due to unexpected variables are examples of such issues (Oleghe & Salonitis, 2014). Failure to properly integrate and execute plans and control may drive up operating costs, perhaps leading to a business's closure. It also seems that if production plans and control are done poorly, the firm's profitability would suffer. PPC is used to reduce costs and help businesses to expand. Changes connected with company expansion, particularly in a developing nation like Nigeria, affect production costs and planning.

Ikon and Nwankwo (2016), Millicent (2017), and Ovunda, Isaac, and Ndor (2019), among others, gave less attention to the important metrics of PPC influence on performance, such as; quality control, inventory management, material requirement planning, while the study of Wen-Hsien and Yin-Hwa (2018) did not consider the measures of PPC to know the impact of these measures on performance. The sample sizes employed by Yazan (2017), Millicent (2017), Ovunda (2019), Sambil, Matimba, Sihle, Xolani, and Sine (2019) were also insufficient for drawing conclusions from a study of this kind. Case analysis, regression, and correlation analysis were the foundations for the investigations conducted by Sambil et al. (2019) and Millicent (2017), and very few research used structural equation modeling (SEM) for data analysis. Furthermore, there are few research on production planning and control in Nigeria. The goal of this study is to add to the body of research on production control by examining the impact of production control on operational efficiency.

Statement of the Problem
The food and beverage industry plays a crucial role in the economy of Akwa Ibom State, contributing significantly to employment generation and revenue generation. However, there are significant challenges regarding the production control and operational efficiency of food and beverage firms in the state. It has been observed that many food and beverage firms in Akwa Ibom State lack robust production control systems. This leads to challenges in managing and optimizing production processes, resulting in inefficiencies, waste, and substandard quality. The absence of effective control measures hampers the ability of firms to meet customer demands promptly and maintain consistency in product quality. According to Infor (2012), food and beverage companies can only succeed if they deliver effective management of operational constraints made possible in part by an improved formulation strategy that ensures more value, faster, and for less cost. The utilization of technology in production processes is crucial for enhancing operational efficiency. However, numerous food and beverage firms in Akwa Ibom State have limited access to and adoption of modern technological tools and equipment. This limitation restricts their ability to streamline production processes, automate tasks, monitor inventory, and optimize resource utilization, thereby impeding overall operational efficiency. In view of the varying challenges; this study therefore sees to investigate the relationship between production control on operational efficiency of food and beverage firms in Akwa Ibom State.
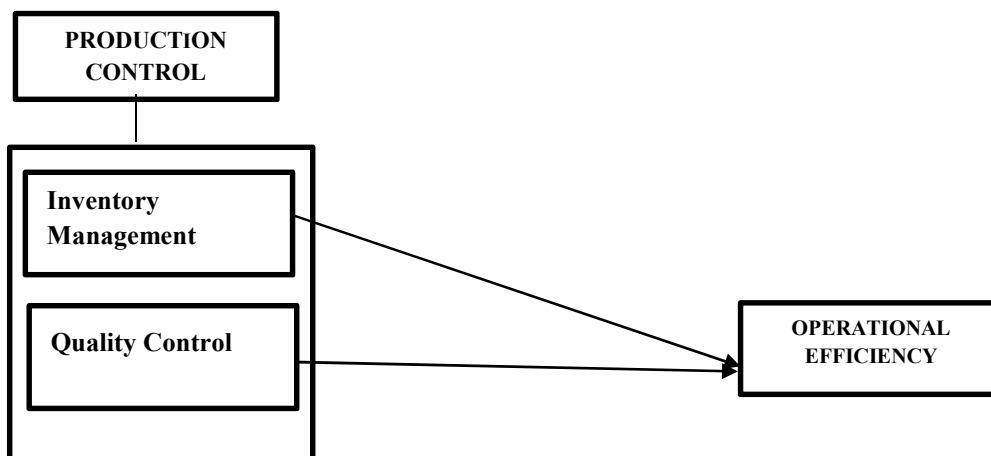

Fig 1: Conceptual framework on the link between production control and operational efficiency

Source: Conceptualized by the researcher, 2023

Objectives of the Study

The specific objectives are to examine the relationship between;

1. Inventory management and operational efficiency

2. Quality control and operational efficiency.

Research Hypotheses

$H0_1$: There is no significant relationship between inventory management and operational efficiency of food and beverage firms in Akwa Ibom State.

$H0_2$: There is no significant relationship between quality control and operational efficiency of food and beverage firms in Akwa Ibom State.

Literature Review

This work is based on Theory of Constraints Application (TOC) which originated from the works of Eli Goldratt in 1984 and it has become a critical subject matter within the operations management research. The Theory of Constraints begins by recognizing that every system, whether it's a manufacturing process, a supply chain, or a service delivery system, is limited by its constraints. A constraint refers to any factor that restricts the system's ability to achieve its goals. Constraints can manifest in various forms, such as limited capacity, resource scarcity, or inefficient processes. The first step in implementing TOC is to identify the constraints within the system accurately. Once the constraints are identified, the Theory of Constraints emphasizes the need to exploit and optimize the utilization of these constraints. Rather than considering constraints as obstacles, TOC suggests viewing them as opportunities to improve overall performance. By focusing on the constraints, organizations can develop strategies to maximize their throughput, ensuring that the most critical elements of the system operate at full capacity. Collier and Evans (2006) state that TOC is a collection of axioms and principles that ensure related activities capable of creating bottlenecks in the production areas and process are resolved by increasing total process throughput. A number of researches have applied TOC to explain the effect of production planning and control on performance of organisations (Ekpudu, 2016; Cardoso, 2021; Stevenson, 2007; Jacob, Berry, Whybark & Vollmann, 2011). The theory is connected to effective planning and controlling of production processes, resource consumption and other activities to minimise or avoid constraints that hinder performance of organisation. TOC applies to production process, as well as addresses how bottlenecks are identified and managed in the production process. A vigorous application of TOC improves operations, minimises lead time, reduce inventory level, and optimise performance of organisation. Jacob et al (2011) opine that manufacturing goals could be deterred by constraints and that operations performance could be enhanced through TOC scheduling of activities. This study adopts the theory of constraint because it enables managers to

effectively plan and control resources by avoiding constraints that could limit organisational performance.

Concept of Production Control

Production control refers to the systematic coordination and regulation of manufacturing activities to achieve efficient production processes and meet customer demand. It entails organising, coordinating, leading, and controlling various aspects of production, including resources, materials, machines, and labor. The primary objective of production control is to optimize resource utilization, minimize lead times, enhance product quality, and ultimately maximize customer satisfaction. Production has to do with the procedure for transforming resources into output, while planning is all about the determination of what and how to produce goods and services in an organisation. Every production activity needs input resources such as currency, individuals, machinery, materials information, and power. Production of goods and services must be correlated with consumer needs, as evidenced by a constant flow of clients and consumer growth (Jain & Aggarwal, 2008). Consequently, in order to attain effectiveness and efficacy, production and distribution of items and offerings, must be carried out in a manner that ensures customers' satisfaction, and cost-effectiveness. The process involved in developing effective relationship between production capability and market demands is the primary role of production planning (PP). Production planning is the method of planning production needs in advance, such as basic supplies and components, production runs, precise machinery, order priority, labour costs, and the manufacturing process itself, within the confines of the company to guarantee that products produced meet needs. Businesses can implement solid production planning by managing inventory, operations, delays, and shifting operational levels successfully (Jain & Aggarwal, 2008).

Quality Control

The major priority of every industrial system is quality. Quality assurance is critical for assuring process and product reliability. In a production system, quality must be guaranteed from the start of each phase. It is vital to verify that only high-quality goods with no faults or rejections are moved on to the next workstation and that they fulfill the standard requirements. This is in sharp contrast to the previous quality control method, which involved work being passed from one workstation to the next without quality assurance and inspection being done in large batches at the end of the production process. One of the fundamental stages in the production system to ensure quality is worth at the basis (both processes and products). Ringen, Aschehoug, Holtskog, and Ingvaldsen (2014) emphasised the significance of taking this action by pointing out that if an irregularity develops, the machinery or procedure can be swiftly stopped. Implementing quality at the cause may be successful if production is done in small quantities. High quality may be safeguarded if small batch size rules are followed (Sangwan, Bhamu, & Mehta, 2014). With precise accuracy, the cause of the problem may be identified. At the same time, it guards against the occurrence of flaws. As a consequence, each phase ensures that no defective units are given to subsequent procedures.

Inventory Management

Prempeh (2016) posits that an inventory system is a set of policies and controls put in place in a manufacturing setup for monitoring as well as determining the volume/levels of inventory and replenishment that a firm should keep. To achieve optimal results, the managers of manufacturing firms must bear in mind the goal of minimising costs of inventory and satisfying the needs of customers. A robust Inventory Management (IM) system must be in place at various locations/branches within a manufacturing facility and/or various locations of a distribution network to ensure that regular, as well as planned courses of production are prevented from random disturbance of stockout components/materials. Additionally, IM encompasses asset management, cost of keeping an inventory, physical inventory, sale forecasting, products replenishment, the physical space available, lead time management, defective products, quality management, price forecasting, inventory valuation, and visibility. Ogbo, Onekanma, and Wilfred (2014) add that an optimal inventory level can be attained by achieving effective management of the above-mentioned scope, which every firm both in the service and manufacturing set-up should incorporating into their business process to respond to changes in the business environment.

Operational Efficiency

Efficiency is defined by Peter Drucker as "doing things right". (1963; Drucker). Efficiency is a crucial component that influences profitability and long-term viability according to numerous research. Eskandari (2007) asserted a connection between a company's overall success and efficiency. The best possible use of an organization's resources is a key component of efficiency in operations. Businesses must effectively produce their output from inputs if they want to survive and grow. Cost and product distinction are the essential components of effective competitive tactics, according to Michael Porter (Tanwar, 2013; Porter, 1989). Cost leadership strategies' foundation is operational effectiveness. A company that can produce goods and services that are comparable to those of rivals while charging the least amount of money is considered a cost leader in that market. This requires him to generate a specific quantity of output using minimal input. The cost leader has strong competitive advantage as he can simply decide to reduce his price to the minimum amount required to remain profitable so as to capture larger portion of the market share, thus forcing competitors to either reduce their prices. Some competitors can only bear a certain level of reduction in profit to justify remaining in business and so may be forced to quit. It is a case of "give in or give up" (i.e. reduce prices or quit). Academics and business leaders continue to place a high priority on operational efficiency in the manufacturing sector. According to Asaleye et al. (2018), an effective manufacturing sector is a key factor in finding solutions to the issues of unemployment and long-term economic growth.

Production Control and Operational Efficiency

Every area of operation and production management, particularly in these days of industry, depends heavily on production control (Wolniak, 2020; Wolniak, et al., 2020; Amjad, et al., 2021). Without proper level of control we cannot achieve the proper level of quality of product and

because of that we cannot achieve proper level of fulfillment of customers demand. All organisational processes can be regulated and computerised in the era of Industry 4.0 (Gajdzik and Wolniak, 2021; Kadir and Broberg, 2021). Production control and it's methods vary between particular firms and plants because for now not all organizations have sufficient level of digitalization. The level of digitalization has an important impact on the method used to control the production processes.

According to Chapman (2006), production planning is the process of anticipating each step in a long chain of independent activities; actions must be conducted in the correct place at the appropriate time, and each operation must be completed as efficiently as possible. The big picture of production planning is how things are going to be in the future. It will assist in setting up a production site by making it easy to obtain the requirements. The only efficient organization allows for the most effective planning and strategy for the manufacturing process, which is the fundamental mechanism for converting raw materials into completed goods or services. (Graves, 2011). The planning horizon is a regularly defined period during which a production plan is established. When it comes to creating a production plan, the production planner, planning manager, or entire production planning department must collaborate with the marketing and sales departments to develop a sales projection or an extensive list of customer orders.

Empirical Related Studies

Sambil, Matimba, Sihle, Xolani, and Sine (2019) conducted a study in selected South Africans' organisations to ascertain the influence of JIT on SMEs' performance and assess if the philosophy of JIT can be applied in South African SMEs. The study was based on an explanatory research design and deployed the correlation technique of data analysis. It was revealed that firms in South Africa (SA) are test running the JIT application and eventually exhibiting a high level of improvements in monetary terms, employee morale, and customer loyalty. Indeed, the level of productivity in SA SMEs has been greatly influenced positively by JIT production system. Hence, JIT is a robust and applicable principle to adopt by firms in that there are a lot of benefits to derive from it. Ovunda, Isaac, and Ndor (2019) ascertained the degree to which production planning/control has been applied and implemented in the beverage industry of Nigeria as well as how PPC application has enabled the studied firms to reduce cost of operations as well as other operating expenses. Three firms were studied within the industry and a sample of 97 participants were selected from the studied firms. The findings showed that PPC is used by the firms for decision making and there was an effective application of PPC in the studied firms. Furthermore, it was revealed that PPC is significantly instrumental in minimising cost of operations.

Okah, Nduka, and Ugwuegbu (2018) evaluated production planning effect on firms' effectiveness in the Nigerian food and beverage industry. The firms' effectiveness was proxied by Sales volume, inventory cost minimisation, and customer satisfaction. Primary data were collected with the aid of self-administered questionnaire's copies. The study adopted Chisquare for data analysis and production planning was revealed to have had a positive and significant influence on sales volume, inventory cost reduction, customer satisfaction. It implies that a firm's effectiveness is greatly affected by production planning. Therefore, demand forecasting and material requirements planning must be carried out by manufacturing firms in a bid to identify and meet the needs of customers.

Tekalign (2020) carried out a study in Hawassa City to find out how effective the practices of inventory management were in manufacturing companies. A descriptive research design was adopted and a self-administered questionnaire was used for data collection. It was indicated that a lot of procedures of inventory management were experienced by the studied firms in an attempt to maintain a reasonable level of stock and prevent stockout to satisfy both current and future customers' demand. The results of the study also revealed that a robust practice of IM was in place in the studied firms. Nevertheless, the study's result showed that severe long lead time challenges were encountered by some of the firms as a result of bureaucratic processes involved in receiving materials or parts ordered which led to cancellation of purchase orders and results in loss of customers.

Methodology

This study adopted quantitative research design using a survey method. The study population comprised of five food and beverage firms randomly selected by the researchers. The frame of 321 management staff from the five (5) food and beverage firms were surveyed through questionnaire administration. The questionnaire was divided into three parts involving questions relating to respondents' profile. After data cleansing 302 copies of the questionnaire were retrieved and used for data analysis. The items that were used to measure the variables in this study were based on theory and largely drawn from the literature. Reliability analysis was performed in order to ensure the internal consistency and reliability of measures. Cronbach's alpha was calculated to confirm the reliability of the study constructs. The reliability coefficient obtained was 0.87 which exceeded the rule of thumb cut-off mark of 0.70 as suggested by Hatcher (1994) thereby confirming that the items are internally related to the factors they are expected to measure. The Spearman's Rank Order Correlation Coefficient statistical tool of analysis was adopted in testing the relationship between these variables under study.

Results and Discussion

The dimensions of production control:-quality control and inventory management were all correlated against the dependent variable operational efficinecy.

Hypothesis One

$H0_1$: There is no significant relationship between inventory management and operational efficiency of food and beverage firms in Akwa Ibom State.

Table 1: Statistical Analysis for Hypothesis One

			Inventory Management	Operational Efficiency
Spearman's rho	Inventory Management	Correlation Coefficient	1.000	.845**
		Sig. (2-tailed)	.	.
		N	302	302
	Operational Efficiency	Correlation Coefficient	.845**	1.000
		Sig. (2-tailed)	.	.
		N	302	302

**. Correlation is significant at the 0.01 level (2-tailed).

From the result of the above table, the correlation coefficient (r = 0.845) between inventory management and operational efficiency is very strong and positive. The coefficient of determination (r^2 = 0.85) indicates that 85% of operational efficiency can be explained by inventory management. The significant value of (p< 0.05) reveals a significant relationship. Based on that, the null hypothesis was rejected. Therefore, there is a significant relationship between inventory management and operational efficiency of food and beverage firms in Akwa Ibom State. In submission of the findings; Ogbo, Onekanma, and Wilfred (2014) add that an optimal inventory level can be attained by achieving effective management of the above-mentioned scope, which every firm both in the service and manufacturing set-up should incorporating into their business process to respond to changes in the business environment.

Hypothesis Two
$H0_2$: There is no significant relationship between quality control and productivity of food and beverage firms in Akwa Ibom State.

Table 2: Statistical Analysis for Hypothesis Two

			Quality Control	Operational Efficiency
Spearman's rho	Quality Control	Correlation Coefficient	1.000	.766**
		Sig. (2-tailed)	.	.
		N	302	302
	Operational Efficiency	Correlation Coefficient	.766**	1.000
		Sig. (2-tailed)	.	.
		N	302	302

**. Correlation is significant at the 0.01 level (2-tailed).

From the result of the above table, the correlation coefficient (r = 0.766) between quality control and operational efficiency is very strong and positive. The coefficient of determination (r^2 = 0.77) indicated that 77% of operational efficiency can be explained by quality control. The significant

value of (p<0.05) reveals a significant relationship. Based on that, the null hypothesis is rejected. Therefore, there is a significant relationship between quality control and operational efficiency of food and beverage firms in Akwa Ibom State. Implementing quality at the origin may be successful if production is done in small quantities. High quality could be safeguarded if small batch size rules are followed (Sangwan, Bhamu, & Mehta, 2014).

Conclusion and Recommendations

From the results of the study, the paper concludes that production control has substantial influence on operational efficiency in food and beverage firms. The specific conclusions include: Inventory management has a significant and positive effect on operational efficiency. Effective inventory management via stock availability, inventory accuracy, and capacity utilisation would optimise the profit earnings of firms. Quality control has a significant and positive influence on operational efficiency. Strategic control of quality would enhance the quality delivery and satisfy the delivery time required by the customers. Following the findings and conclusions, the study made the following recommendations:

1. Operation managers should have sufficient knowledge about production control and especially quality control as such will enable them to boost operational efficiency of the firm.
2. Food and beverage firms can benefit greatly by adopting an integrated inventory management system that tracks and manages inventory levels in real-time. This system can help optimize inventory control, reduce wastage, and ensure timely availability of raw materials.
3. The organization should implement a robust quality control system that involves establishing standard operating procedures (SOPs) for quality checks, inspections, and testing at various stages of the production process.

References

Abraham, S. (2012). Development of employee engagement programme on the basis of employee satisfaction survey. *Journal of Economic Development, Management, IT, Finance and Marketing, 4*. 1, 27-37

Amjad, M.S., Rafique, M.Z., Khan, M.A., (2021). Leveraging optimized and cleaner production through industry. *Sustainable Production and Consumption, 26*, 859-871.

Amusan Lekan, M., Adedamola, O., Adelakun, A., Patience, T.O. & Ogunde Ayodeji, O. (2013), Target output, extended output and site productivity: tales of the expected. *Journal of Environment and Earth Science, 3*. 3, 38-45.

Arora, M.M. (2000). *A textbook cost accounting*. New Delhi: CBS Publishing Limited.

Asaleye, A. J, Adama, J. I, & Ogunjobi, J. O. (2018). Financial sector and manufacturing sector performance: evidence from Nigeria. *Investment Management and Financial Innovations 15*(3),35-48.

Bashir, M. I. (2020). Control Of management in an organization," Palarch' S J. Archaeol. EGYPT/EGYPTOLOGY,[Online].Available:https://archives.palarch.nl/index.php/jae/article/view /3133.

Brynjolfsson, E. (1993). The productivity paradox of information technology. *Communications of the ACM, 36*(12), 66-77

Cardoso, O. O. (2021). The effect of production planning and control on organizational performance in the Nigerian cement manufacturing industry. M.Sc Thesis, Department of Business Administration, University of Lagos, Akoka-Yaba, Nigeria.

Carter S.A. (2002). *Production and inventory control handbook*. New York: McGraw- Hill

Chapman, S. N. (2006). *The fundamentals of production planning and control*. Upper Saddle River, NJ: Pearson/Prentice Hall.

Chase, R. B., Aquilano, N. J., & Jacobs, F. R. (2021). *Operations management for competitive advantage*. McGraw-Hill Education.

Drucker, P. F. (1963). Managing for business effectiveness. *Harvard Business Review 41*, 53-60

Ekpudu, J. E. (2016). *Quality management practices and performance of selected firms in the nigerian downstream oil sector*. Ph.D. Thesis, Department of Management and Accounting, Obafemi Awolowo University, Ile-Ife, Nigeria

Eni, O. (2001). *Small business management*. Port Harcourt Press Limited.

Eskandari, J. (2007). *Accounting principles*. Tehran Sazeman Publishers.

Gajdzik, B., Wolniak, R., (2021). Influence of the COVID-19 crisis on steel production in Poland compared to the financial crisis of 2009 and to boom periods in the market. *Resources, 10*(1), 1-17

Graves, S.C. (2011). *Uncertainty and production planning. In Planning production and inventories in the extended enterprise*. Springer, New York, NY,

Hanley, C. (2014). Putting the bias in skill-biased technological change? A relational perspective on white-collar automation at general electric. *American Behavioral Scientist, 58*. 3, 400-415.

Hensley, R. L., & Utley, J. S. (2019). Assessing the cumulative effect of service errors on customer perceptions. *Journal of Service Science and Management, 12*, 521-530. https://doi.org/10.4236/jssm.2019.124035

Heutel, G. (2012). How should environmental policy respond to business cycles? Optimal policy under persistent productivity shocks. *Review of Economic Dynamics, 15*(2), 244-264.

Jacob, F. R., Berry, W. L., Whybark, D. C. & Vollmann, T. E. (2011). Manufacturing Planning and control for supply chain management (6thEd) McGraw-Hill/Irwin Series Operations and Decision Sciences. NY

Jacobs, F. R., & Chase, R. B. (2018). *Operations and supply chain management (15th ed.).* McGraw-Hill Education.

Jain, K. C; & Aggarwal, L, N. (2008). Production planning, control and industrial management. Delhi, Nai-Sarak: Khalma Publishers

Jain, K. C.; & Aggarwal, L, N. (2008) Production Planning, Control and Industrial Management, Delhi, Nai-Sarak: Khalma Publishers

Kadir, B.A., & Broberg, O. (2021). Human-centered design of work systems in the transition to industry 4.0, Applied Ergonomics, 92, 103334.

Karlaftis, M.G. (2004). A DEA approach for evaluating the efficiency and effectiveness of urban transit systems. *European Journal of Operational Research, 152*(2), 354-364.

Krajewski, L. J., Ritzman, L. P., & Malhotra, M. K. (2018). Operations management: processes and supply chains. Pearson.

Lahti, R. K., Darr, E. D. & Krebs, V. E. (2002). Developing the productivity of a dynamic workforce: the impact of informal knowledge transfer. *Journal of Organizational Excellence, 21*, 2, 13-21.

Lillrank, P. (2003). The Quality of Information. International Journal of Quality & Reliability Management, 20, 691-703.

Miller, R. (2010). *Inventors control: Theory and practice*. New Jersey: Prentice Hall.

Mitchell, R. J., Ozminkowski, R. J. & Serxner, S. (2013). Improving employee productivity through improved health. *Journal of Occupational and Environmental Medicine, 55*. 10, 1142-1148.

Mohanty, R. P. (1998). Understanding the integrated linkage: quality and productivity, *Total Quality Management, 9*. 8, 753-765
\
Nahmias, S. (2015). Production and operations analysis. Waveland Press.

Ogbo, A. I.,Onekanma I. V and Wilfred I. U (2014). The impact of effective inventory control management on organisational performance: A Study of 7up Bottling Company Nile Mile Enugu, Nigeria. *Mediterranean Journal of Social Sciences, 5*(10), 43-65.

Porter, M. E. (1989). How competitive forces shape strategy. In Readings in strategic management. Palgrave, London.

Prashar, A. (2020). Quality management for high-contact professional service firms: a multiple-case evidence from indian law firms. *International Journal of Quality & Reliability Management*, *38*, 413-436.

Sangwan, K. Bhamu, S., J. & Mehta. D. (2014). Development of lean manufacturing implementation drivers for Indian ceramic industry. *International Journal of Productivity and Performance Management* 63(5): 569-587.

Sharma S. C. (2004). *Materials management and materials handling*. New Delhi: Khana Publishers Limited.

Slack, N., Brandon-Jones, A., & Johnston, R. (2016). Operations Management (8th ed.). Pearson Education Limited.

Sousa, R., & Voss, C. A. (2002). Quality management re-visited: A reflective review and agenda for future research. *Journal of Operations Management, 20*, 91-109. https://doi.org/10.1016/S0272-6963(01)00088-2

Stevenson, W. (2007). *Operations management. Theory and practice*. Mac Graw –hill companies. United States of America.

Stevenson, W. J. (2018). *Operations management (13th ed*.). McGraw-Hill Education.

Stevenson, W. J., & Hojati, M. (2017). Operations management. McGraw-Hill Education.

Tanwar R (2013). Porter's generic competitive strategies. *Journal of Business and Management 15*(1), 11-17.

Vollmann, T. E., Berry, W. L., Whybark, D. C., & Jacobs, F. R. (2017). *Manufacturing planning and control for supply chain management*. McGraw-Hill Education.

Wolniak, R. (2020). Quantitative relations between the implementation of industry management systems in European Union countries, Sil. Univ. Technology. *Science. Pap., Organ. Manage,142*, 33-44.