



THE EFFECT OF PRODUCTION PLANNING AND CONTROL ON PRODUCT QUALITY: A STUDY OF INTERNATIONAL BREWERIES IN ILESA, OSUN STATE.

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Abstract

This study investigates the effect of Production Planning and Control (PPC) on product quality at International Breweries Plc in Ilesa, Osun State. The study focuses on three key PPC components: material requirement planning, scheduling system, and product inspection. The study employed cross sectional survey design. The study population comprises 1553 staff working at the manufacturing plant of International Breweries Plc, Ilesa. A sample size of 318 was determined using Taro Yamane's formula.

Online survey was designed to collect data from the respondents. A total of 231 responses were retrieved and analyzed using multiple

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regression analysis. The results indicate that all three PPC components have a positive and statistically significant impact on product quality. Specifically, Product Inspection exhibited the most substantial effect, followed by the Scheduling System and Material Requirement

Planning. These results suggest that investments in strong PPC mechanisms can lead to significant improvements in production outcomes, reinforcing the importance of continuous optimization of PPC processes. The study concludes with recommendations for International Breweries Plc and similar	organizations to enhance their PPC practices, thereby improving product quality and customer satisfaction.
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INTRODUCTION

Background to the Study

In the competitive world of beverages, consumer loyalty hinges on consistent product quality. In particular, beer production involves a multi-step processes that demands a careful attention to detail to deliver a product that meets established taste profiles (Bamforth, 2020). Furthermore, the rate of product defects is an important measure of a company's efficiency and quality control processes. High defect rates can significantly impact a company's reputation and customer satisfaction (Sadikin, 2023).

For instance, in the brewery industry, consistent issues with product quality can lead to customer dissatisfaction and a loss of brand loyalty. Customers who repeatedly encounter defective products are likely to lose trust in the brand and seek alternatives, which can lead to a decline in sales and market share (Johnson & Brown, 2021). This phenomenon is particularly evident in the context of breweries, where the quality of the product is paramount. Poor quality control can result in off-flavors, contamination, or packaging issues, all of which can deter customers from repurchasing (Aadil et al., 2019).

In Nigeria, economic downturns have aggravated these challenges for brewery firms. It has made it difficult for companies to determine the best strategies to adopt in order to maintain product quality. Moreover, recent inflation and fluctuating exchange rates have increased the cost of raw materials, which in turn has forced breweries to raise their prices (Olamide et al., 2022). However, this strategy can backfire as it may lead to decreased consumption among price-sensitive customers (Adams & Eze, 2021). For instance, Nigerian Breweries, one of the major players in the industry, has faced criticism from consumers who have observed a decline in product quality even as prices have

increased. This decline in quality is often attributed to cost-cutting measures aimed at maintaining profitability during tough economic times (Kim & Park, 2018).

These issues highlight significant challenges in maintaining product quality during economic downturns. Companies must balance the need to control costs with the imperative to maintain high-quality standards. Failure to do so can result in a vicious cycle of declining quality, customer dissatisfaction, and reduced sales, which can ultimately threaten the company's viability. It is therefore essential for breweries to invest in strong quality control processes and adopt effective production planning control strategies to mitigate the impact of economic fluctuations on product quality.

Effective PPC is crucial for minimizing waste, optimizing resource allocation, and ensuring timely delivery of products (Mullins, 2022). Against this backdrop, this study aims to examine the effect of production planning and control on product quality of International Breweries Plc, Ilesa, Osun state.

REVIEW OF LITERATURE

Conceptual Review

Production Planning and Control

Production Planning and Control (PPC) is a vital aspect of manufacturing that ensures the efficient use of resources, smooth workflow, and timely delivery of products. PPC is a two-fold process that begins with production planning and ends with production control. Production planning involves determining what, when, and how much to produce (Ekpudu et al., 2022). It includes setting production targets, estimating resources needed, and scheduling the production process. The goal is to ensure that the production process is efficient and cost-effective (Oyedokun & Adelodun, 2023). Production control, on the other hand, involves monitoring and adjusting the production process to ensure that everything goes according to the plan. The aim is to maintain the quality of the product and ensure that it is delivered on time (Amare et al., 2023).

One of the key benefits of PPC is improved productivity. Planning and controlling the production process helps manufacturers to optimize the use of their resources, reduce downtime, and increase the overall efficiency of their

operations. This can lead to higher output and lower costs, which can enhance the competitiveness of the company (Wolniak, 2021).

Materials Requirement Planning

Materials Requirement Planning (MRP) is a system used in manufacturing to manage production processes efficiently. It involves the planning of materials and components required for production, ensuring that the right quantities are available at the right time (Kithure & Paul, 2022). This planning system integrates data from various sources, including inventory records, the master production schedule, and the bill of materials, to calculate the precise material requirements. The primary objective of MRP is to ensure that materials and components are available for production, while also maintaining the lowest possible inventory levels, thereby optimizing the entire manufacturing process (Kamalu et al., 2023).

MRP systems have proven to be highly useful in manufacturing due to their ability to streamline production processes (Odunayo & Obom, 2021). Provision of detailed schedules for the acquisition and use of materials, also helps in reducing production lead times and minimizing the risk of stockouts or excess inventory (Najy, 2020). This level of precision in planning is crucial for maintaining continuous production flows and meeting customer demands promptly.

Furthermore, MRP enhances the efficiency of resource allocation, enabling manufacturers to use their resources more effectively and reduce waste (Kithure & Paul, 2022). The necessity of MRP in manufacturing cannot be overstated. In a highly competitive market, manufacturers must ensure that their production processes are as efficient as possible to maintain profitability. MRP systems help achieve this by providing a structured approach to managing materials and components, thereby reducing the likelihood of production delays caused by material shortages (Sakpaide, 2024).

Scheduling System

Manufacturing firms face the complex challenge of efficiently managing their production processes, which is where an effective scheduling system becomes essential. Scheduling systems in manufacturing are designed to optimize the

allocation of resources, streamline production workflows, and ensure timely delivery of products to meet customer demands (Cieplinski et al., 2022). These systems integrate various components, including labor, equipment, and materials, to create a cohesive plan that minimizes downtime and maximizes productivity (Chen et al., 2023).

A scheduling system facilitates the planning and execution of manufacturing operations by defining when and how resources will be utilized (Prashar et al., 2022). This involves setting specific timelines for production activities, prioritizing tasks based on urgency and importance, and adjusting schedules in real-time to accommodate changes in demand or unexpected disruptions (Geurtsen et al., 2023).

Product Inspection

Product inspection is a critical component of quality assurance in manufacturing, ensuring that products meet specified standards and are free from defects before they reach consumers. This systematic process involves examining a sample of products against predetermined criteria, including appearance, functionality, and construction, to verify compliance with quality standards (Qamar et al., 2024). The importance of product inspection cannot be overstated, as it plays a vital role in preventing defective products from entering the market, thereby safeguarding both consumer safety and the manufacturer's reputation. The product inspection process typically occurs at various stages of production, including initial inspections of raw materials, in-process checks during manufacturing, and final inspections before shipment. Each stage serves to identify potential quality issues early on, allowing for timely corrective actions. This proactive approach helps minimize costly reworks and delays that can arise from quality failures later in the production cycle.

Moreover, the distinction between product inspection and product testing is essential to understand. While product inspection involves assessing the overall quality of finished goods, product testing typically occurs in controlled environments, such as laboratories, to evaluate compliance with safety and regulatory standards (Garcia, 2024). Both processes are complementary, with inspection focusing on visual and functional assessments, and testing verifying adherence to specific regulations.

Product Quality

Product quality encompasses the ability of a product to meet or exceed customer expectations and industry standards. It is a critical determinant of consumer satisfaction and loyalty, influencing purchasing decisions and brand reputation (Lone & Bhat, 2023). The definition of product quality can vary significantly depending on the perspective from which it is viewed, such as that of the consumer, manufacturer, or industry standards. From the consumer's standpoint, product quality is often associated with attributes such as functionality, durability, reliability, and overall appeal. Consumers expect products to perform effectively and to be free from defects, which directly impacts their satisfaction and likelihood of repeat purchases (Bhowmick & Seetharaman, 2023).

For manufacturers, quality is evaluated through the lens of engineering practices, the materials used, and adherence to production standards. This perspective emphasizes the importance of quality control processes and the selection of high-grade raw materials to ensure that the final product meets specified criteria. The significance of product quality extends beyond consumer satisfaction; it is also a strategic business imperative. High-quality products can lead to increased market share and profitability, while poor quality can result in costly recalls, damage to brand reputation, and loss of customer trust (Bhowmick & Seetharaman, 2023). Companies that prioritize quality are often able to differentiate themselves in competitive markets, leveraging their reputation for excellence to attract and retain customers.

Theoretical Framework

Total Quality Management Theory

Total Quality Management (TQM) is a comprehensive management approach focused on continuous improvement, customer satisfaction, and the involvement of all employees in enhancing processes, products, and services (Umar, 2023). TQM emphasizes that quality is not merely a function of the production department but a collective responsibility that permeates every aspect of an organization. This philosophy is grounded in several key principles, including customer focus, total employee involvement, a process-centered

approach, integrated systems, and a commitment to continuous improvement (Sankala, 2024).

For this current study, TQM serves as a vital theoretical framework. The brewery industry, characterized by its competitive nature and stringent quality requirements, can benefit significantly from TQM principles. By applying TQM, International Breweries can enhance its production planning and control processes, leading to improved product quality and operational efficiency. One of the core tenets of TQM is the customer-centric focus, which posits that the ultimate measure of quality is determined by customer satisfaction (Gabriela-Livia, 2021). In the brewing industry, this translates to producing beverages that meet consumer preferences and safety standards. By integrating customer feedback into production planning, International Breweries can ensure that its products align with market demands, thereby enhancing quality and customer loyalty.

Moreover, TQM encourages total employee involvement, which is crucial for fostering a quality-oriented culture within the organization (Pambreni et al., 2019). Employees at all levels are empowered to participate in quality improvement initiatives, which can lead to innovative solutions and greater accountability. In the case of International Breweries, involving employees in production planning and control can help identify potential quality issues early in the process, reducing waste and improving overall product quality. The process-centered approach of TQM also aligns closely with production planning and control. By focusing on the processes that transform inputs into finished products, International Breweries can systematically analyze and improve its operations.

Furthermore, TQM's emphasis on continual improvement is particularly relevant for the dynamic nature of the brewing industry. As consumer preferences and market conditions evolve, International Breweries must remain agile in its production planning and control strategies. By fostering a culture of continuous improvement, the brewery can adapt to changes, enhance product quality, and maintain a competitive edge in the market.

Empirical Review

Kamalu et al. (2023) examined the relationship between material requirement planning (MRP) and supply chain performance in multinational FMCG

companies in Port Harcourt. Using a survey research design and Pearson Product Moment Correlation, they analyzed data from 43 top managerial staff. The findings revealed a significant positive relationship between MRP and supply chain performance, recommending regular optimization of MRP schedules to enhance supply chain performance.

Kithure & Paul (2022) investigated the role of material requirement planning on operational performance in the East African manufacturing industry. The study used a descriptive research design, focusing on 10 manufacturing firms. Primary data was collected via questionnaires, and secondary data was gathered from various sources. The analysis showed that elementary scheduling systems, inventory control systems, capacity requirement planning, and demand forecasting systems all positively impacted operational performance. The study recommended enhancing resource utilization through effective scheduling systems to improve operational performance.

Odunayo & Obom (2021) explored the relationship between material requirement planning and supply chain performance in oil and gas firms in Rivers State, Nigeria. Using an explanatory research design and Pearson's Product Moment Correlation, they analyzed data from 149 management staff. The study found a significant positive relationship between MRP and supply chain performance, suggesting the need for effective MRP practices to boost supply chain performance.

Kesavan et al. (2021) assessed the impact of responsible scheduling practices on store financial performance at Gap, Inc. A randomized field experiment in 28 stores over nine months revealed that responsible scheduling practices increased store productivity by 5.1%, driven by a 3.3% rise in sales and a 1.8% reduction in labor costs. The study demonstrated that improving work schedules enhances productivity by boosting employee effort and adherence to labor plans.

Akpaetor & Akpan (2022) examined the contribution of production scheduling to the productivity of transport companies in Akwa Ibom State. Using Spearman Ranked Correlation, they analyzed data from 60 transport company managers. The results showed a significant positive relationship between production scheduling and productivity, recommending the adoption of computerized scheduling systems to enhance operational efficiency.

Mittal & Gupta (2021) investigated the impact of total quality management (TQM) on product quality and customer satisfaction in a tractor manufacturing industry in Punjab, India. Implementing TQM led to significant improvements in quality, revenue, and market share. The study highlighted the shift from traditional inspection to quality assurance, resulting in enhanced product quality and customer satisfaction.

Conceptual Framework

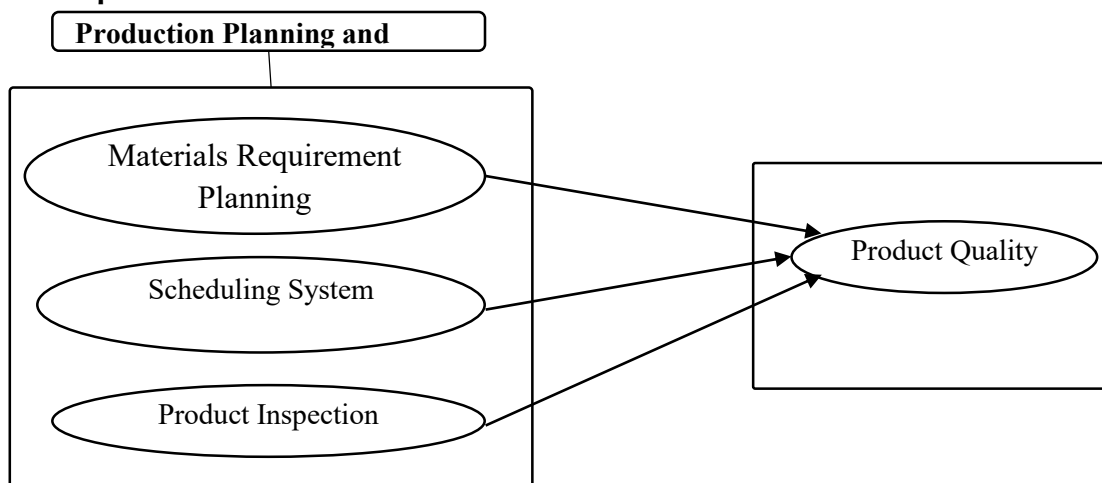


Fig 1: Conceptual Framework of the Study

METHODOLOGY

This study employed a cross-sectional survey research design, particularly effective for examining the relationship between production planning and control and product quality at International Breweries, Plc, Ilesa. The target population consists of all employees working at the manufacturing plant of International Breweries. This encompassed a diverse range of roles involved in the production process. This inclusive approach allows for a comprehensive understanding of the perspectives and experiences of employees directly engaged in production activities. According to the firm Annual report, as at 2023, there are 1553 employees working in the manufacturing plant at Ilesa. Using Taro Yamane formula, the sample size is determined to be 318 employees. To ensure a representative sample, a random sampling technique was utilized, giving each employee an equal opportunity to participate in the study.

Data collection was conducted through a structured questionnaire specifically designed to capture relevant information regarding employees' perceptions of PPC (material requirement planning, scheduling system, and product inspection), and product quality. The questionnaire included closed-ended questions to gather quantitative. For the statistical analysis, multiple regression analysis was utilized to examine the relationships between production planning and control (independent variables) and product quality (dependent variable). This analytical approach allows for the examination of the impact of various aspects of production planning and control on product quality.

4.0 RESULTS AND DISCUSSION

Table 1: Survey Response Rate

	Frequency	Percentage
Administered	318	100%
Retrieved	231	72.64%

Table 1 reveals that a total of 318 online survey invitations were sent out using Google Forms, achieving a complete distribution rate of 100%. Within the set time frame for the survey, 231 responses were received, resulting in a response rate of 72.64%. This high response rate indicates strong engagement from the participants, ensuring a substantial amount of data for analysis.

Multiple Regression Results

PPC (materials requirement planning, scheduling system, and product inspection) has not significant effect on product quality of International Breweries Plc, Ilesha, Osun State.

Table 2: Model Summary

Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate
1	.528 ^a	.279	.271		.98665817

a. Predictors: (Constant), Product Inspection, Material Requirement Planning, Scheduling System

The model summary indicates an R value of 0.528, suggesting a moderate level of correlation between the independent variables (PPC components) and the dependent variable (product quality). Furthermore, the Adjusted R Square value of 0.271 implies that only 27.1% of the variance in product quality can be explained by the PPC components included in the model.

Table 3: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.017	3	3.006	3.087	.008 ^b
	Residual	220.983	227	.973		
	Total	230.000	230			

a. Dependent Variable: Product Quality

b. Predictors: (Constant), Product Inspection, Material Requirement Planning, Scheduling System

The ANOVA table provides further insight into the overall significance of the regression model. The regression model, which includes Product Inspection, Material Requirement Planning, and Scheduling System as predictors, yielded a regression sum of squares of 9.017 with 3 degrees of freedom. The mean square for the regression is 3.006. The residual sum of squares is 220.983 with 227 degrees of freedom, resulting in a mean square of 0.973.

The F-statistic, which tests the overall significance of the model, is 3.087. With a significance level (p-value) of 0.008, this result is statistically significant at the 1% level. This indicates that the model as a whole has a statistically significant effect on product quality, suggesting that, collectively, product inspection, material requirement planning, and scheduling system contribute to explaining the 27.1% variance in product quality.

Table 4: Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.332	.065		.000	.001
	Material Requirement Planning	.120	.165	.120	.725	.000
	Scheduling System	.248	.182	.248	1.365	.020
	Product Inspection	.664	.106	.664	.602	.000

a. Dependent Variable: Product Quality

The coefficients table provides detailed information on the individual contribution of each predictor (material requirement planning, scheduling system, and product Inspection) to the product quality at International Breweries Plc. The constant (intercept) of the model is 2.332, with a standard error of 0.065, and is statistically significant ($p = 0.001$), indicating that when all predictor variables are zero, the product quality score is 2.332.

For material requirement planning, the unstandardized coefficient (B) is 0.120 with a standard error of 0.165. The standardized coefficient (Beta) is 0.120, with a t-value of 0.725 and a significance level (p-value) of 0.000. This suggests that material requirement planning has a positive and statistically significant effect on product quality. For the scheduling system, the unstandardized coefficient (B) is 0.248 with a standard error of 0.182. The standardized coefficient (Beta) is 0.248, with a t-value of 1.365 and a significance level (p-value) of 0.020. This indicates that the Scheduling System also has a positive and statistically significant impact on product quality.

For product inspection, the unstandardized coefficient (B) is 0.664 with a standard error of 0.106. The standardized coefficient (Beta) is 0.064, with a t-value of 0.602 and a significance level (p-value) of 0.000. This result shows that product inspection has a positive and statistically significant effect on product quality. In summary, all three PPC sub variables (Material requirement planning, scheduling system, and product inspection) have positive and statistically significant effects on product quality at International Breweries Plc. Production inspection has the most substantial impact, followed by scheduling system, and material requirement planning.

Discussion of Findings

The findings of this study indicate that production planning and control (PPC) have positive and statistically significant effects on product quality at International Breweries Plc. This suggests that effective management and implementation of PPC practices are crucial for enhancing the quality of products in the brewing industry. Notably, Product Inspection has the most substantial impact on product quality, followed by the Scheduling System and Material Requirement Planning. Consequently, the null hypothesis stating that PPC has no significant effect on product quality is rejected.

These results align with recent studies in the field. For instance, Oladipo & Adebayo (2023) found that robust material planning processes are essential for minimizing production disruptions and enhancing product quality in manufacturing firms. Similarly, a study by Olayemi et al. (2022) highlighted the importance of scheduling systems in optimizing resource use and maintaining consistent product quality. Furthermore, Adeyemi and Fapohunda (2021) emphasized that thorough and regular product inspections are vital for identifying and addressing defects early in the production process, thereby ensuring high product standards.

Contrastingly, some studies have noted challenges in implementing PPC effectively. For example, Ibrahim and Ojo (2021) pointed out that while PPC systems are theoretically beneficial, practical issues such as inaccurate demand forecasting and supply chain disruptions can hinder their effectiveness. Moreover, a study by Musa and Onyekachi (2020) observed that in some industries, the benefits of PPC on product quality are not immediately apparent due to the complex interplay of various operational factors.

Overall, the findings from International Breweries Plc support the positive impact of PPC components on product quality, consistent with the broader literature. These results underscore the importance of continuous investment in and optimization of PPC practices to maintain high-quality production standards. Further research could explore the specific mechanisms through which each PPC component influences product quality, as well as investigate potential barriers to effective PPC implementation in different industrial contexts.

CONCLUSION AND RECOMMENDATION

Conclusion

This study investigated the impact of Production Planning and Control (PPC) components—Material Requirement Planning, Scheduling System, and Product Inspection—on product quality at International Breweries Plc in Ilesa, Osun State. The findings indicate that all three PPC components have positive and statistically significant effects on product quality. Among them, Product Inspection was found to have the most substantial impact, followed by the Scheduling System and Material Requirement Planning. These results

underscore the critical role of effective PPC practices in enhancing product quality within the brewing industry. The positive correlation between PPC components and product quality suggests that investments in robust planning and control mechanisms can yield significant improvements in production outcomes. These findings align with existing literature, reinforcing the importance of continuous improvement and optimization of PPC practices to maintain high-quality production standards.

Recommendation

Based on the findings, several recommendations can be made for International Breweries Plc and other similar organizations. Enhancing product inspection processes is crucial, as it has the most significant impact on product quality. This can be achieved by refining inspection protocols, implementing advanced inspection technologies, and providing regular training for quality control personnel to help in the early detection and correction of defects. Optimizing Scheduling Systems is also vital, as it plays a crucial role in product quality. Companies should invest in sophisticated scheduling software that can handle dynamic production demands and optimize resource utilization. Regular reviews and adjustments to scheduling practices can further improve efficiency and product quality.

Strengthening material requirement planning, although it has a comparatively smaller impact, is still significant. Ensuring accurate demand forecasting and maintaining strong relationships with suppliers can help minimize material shortages and production disruptions. Continuous monitoring and evaluation of PPC practices can help identify areas for improvement. Implementing key performance indicators (KPIs) specific to PPC components can provide actionable insights and drive continuous quality enhancements. Providing ongoing training for employees involved in PPC processes ensures that they are well-equipped with the latest best practices and technologies, leading to improved product quality. Leveraging advanced technologies such as automation, AI, and machine learning in PPC processes can enhance accuracy, efficiency, and overall effectiveness. Technology can also provide real-time data and analytics, facilitating informed decision-making.

Contribution to Knowledge

This study makes significant contributions to the existing body of knowledge in the field of production planning and control (PPC) by empirically demonstrating the positive and statistically significant effects of Material Requirement Planning, Scheduling System, and Product Inspection on product quality at International Breweries Plc in Ilesa, Osun State.

Suggestion for Future Studies

Future research could build on the findings of this study by exploring the specific mechanisms through which each PPC component influences product quality. Investigating the underlying processes and interactions can provide a more nuanced understanding of how to optimize PPC practices for better production outcomes. Additionally, future studies could examine the potential barriers to effective PPC implementation in various industrial contexts, identifying common challenges and proposing strategies to overcome them.

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