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Process Innovation and Organisational Productivity of Food and Beverage Producing Firms in Port Harcourt, Nigeria

Wagbara, K. C.

Department of Business Administration, Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt, Rivers State.

*Corresponding author email: kevin.wagbara@iaue.edu.ng

Abstract

This research investigated the link between process innovation and organisational productivity of food and beverage manufacturing companies in Port Harcourt. Employing a descriptive survey design, the study focused on a population of 78 managers across 14 firms in the industry. Primary data were gathered using a questionnaire structured on a modified Likert scale. Demographic information was examined through frequency distribution tables and pie charts, while research questions were assessed using mean and standard deviation. Hypotheses were tested using the Spearman Rank Order Correlation Coefficient. The results indicate a significant association between process innovation and the productivity of these organisations. Consequently, the study concludes that process innovation is positively correlated with organisational productivity. It is recommended, among other suggestions, that management teams within these firms adopt automation and incorporate advanced technologies into their operations. This shift would reduce reliance on manual labour, decrease errors, and improve production efficiency by shortening cycle times.

Keywords: Process Innovation, Organisational Productivity, Time Minimisation and Product Quality.

Introduction

Maintaining high levels of organisational productivity continues to be a primary objective for manufacturing firms, as it is a fundamental driver of efficiency, market competitiveness, and long-term viability in a rapidly changing business landscape. Productivity is the capacity of a firm to meet its goals thru efficient utilisation of resources such as time, labour, technology and capital with the least wastage and highest operational efficiency (Andrew, 2023). In manufacturing companies, organisational productivity is generally measured using measures such as reducing time and improving product quality. Time minimisation refers to the capacity of businesses to reduce delays, accelerate the pace of production and provide products and services on time. Product quality refers to the conformity, reliability and standard of the products manufactured to satisfy customer expectations. Islam and Siengthai (2019) argue that a company's competitive edge in the global arena is directly related to productivity, especially in producing better items in the shortest possible period. Therefore, there is an increasing push on companies to re-align their systems, operational policies and resources toward enhancing performance through efficient process innovation.

The increasing complexity of corporate operations and the process of globalisation have driven businesses to look for contemporary techniques to improve operational efficiency and product quality. Today, with the increase in consumer expectations and market competition, enterprises are under pressure to improve their production processes and operational procedures in an effort to sustain competitiveness and organisational success. Consequently, process innovation has emerged as a critical strategic tool for boosting organisational productivity.

Process innovation refers to the introduction of new or significantly improved manufacturing technologies, operational procedures, and delivery mechanisms that enhance the efficiency and effectiveness of an organization (Richard, 2016). Based on this, Howard (2017) mentioned that process innovation is concerned with the enhancement of the facilities, technical knowledge, skill sets and production frameworks used to provide goods and services. This includes the

adoption of new machinery, automation systems, enhanced software and novel operating methods. These can assist organisations in cutting production time, increasing workflow and enhancing the quality of output.

In manufacturing organisations, process innovation has become necessary as it helps the firms to simplify the operations, eliminate inefficiencies and increase the uniformity of the product standards. Richard (2016) noted that organisations using novel production technologies, modern machinery and sophisticated operational systems are usually more productive than enterprises using outdated production methods. This is because process innovation may raise the speed of operations, reduce delays in production, improve quality control procedures and increase customer satisfaction. Thus, companies that are constantly improving their production processes are more likely to achieve better organisational efficiency through effective time minimisation and better product quality.

Despite the relevance of process innovation, low productivity was seen to be a challenge for many food and beverage manufacturing enterprises in Port Harcourt due to poor adoption of novel production processes and technologies. Many of these companies could still be significantly dependent on obsolete machinery, manual manufacturing processes and inefficient operational systems, which slow down production activities and decrease product quality. Some managers have failed to adapt to automation systems, technical updates and modern production procedures. This has been a major contributor to operational inefficiencies and delays in product delivery. Moreover, insufficient investment in staff training, workshops and skill development programs has hindered the employees' ability to deal with innovative production processes successfully. Consequently, many companies still suffer issues including low product quality, delays in the supply and delivery process, and a growing number of consumer complaints over packaging standards and manufacturing efficiency.

Also, some food and beverage companies appear to be stuck in the old ways of doing manufacturing and marketing activities without paying due consideration to process optimisation and technological advancement. Many companies have failed to attain hoped-for increases in productivity and quality standards because they persist in using outmoded technology and poor operational procedures. Consequently, these operational deficiencies have been a hindrance to enterprises in reducing manufacturing time, reaching uniformity in product quality and competing favourably in the market. In this regard, this study thus examines the relationship between process innovation and the organisational efficiency of food and beverage manufacturing firms in Port Harcourt.

Many firms in the food and beverage production industry in Port Harcourt are still grappling with recurrent problems of product quality and timeliness of operations. This has made organisational productivity a big challenge. Poor time management practices such as delays in production schedules, poor coordination among production teams, outdated production facilities and over-reliance on manual operations continue to hinder operational efficiency and timely product delivery. Bureaucratic regulatory procedures also slow down organisational activity even further and lower output. Poor handling of raw materials, ineffective processing techniques, inadequate storage systems and weak quality control mechanisms continue to cause product quality problems. The result is defective products, customer dissatisfaction and damage to reputation. Furthermore, the spread of counterfeit goods has lowered the confidence of customers in genuine manufacturing enterprises. Poor process innovation seemed to be linked to a continuous decline in the organisational productivity of food and beverage sectors in Port Harcourt. Instead of adopting up-to-date production technology, automation systems and improved operating procedures to boost productivity and product quality, many organisations still utilise obsolete means of production and inefficient operating systems.

The lack of uptake of process innovation has led to lengthened production cycles, operational inefficiencies and reduced product consistency and competitiveness. Poor process innovation is therefore still a major concern influencing the organisational productivity of food and beverage manufacturing enterprises in Port Harcourt. This therefore calls for the need to explore the relationship between process innovation and organisational productivity.

Conceptual Framework

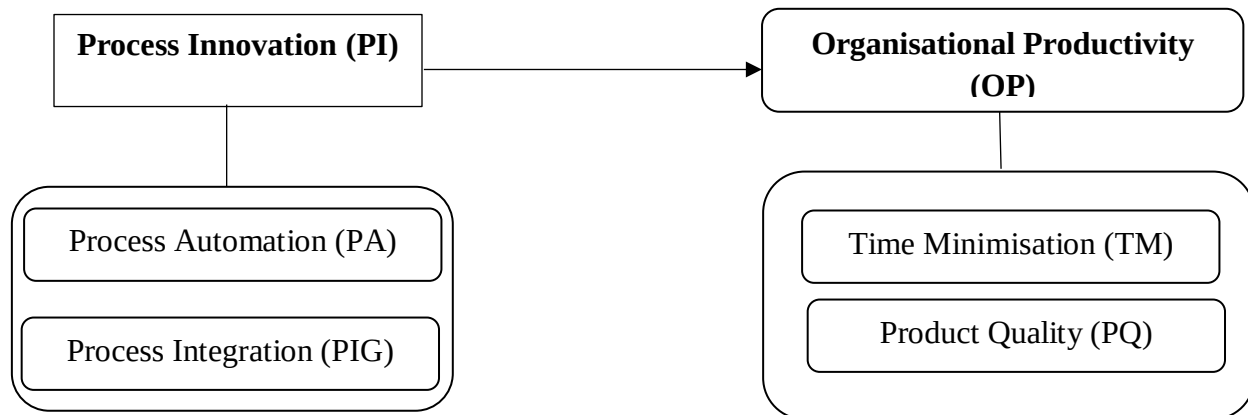


Fig. 1. Conceptual Framework Showing Relationship between Process Innovation and Organisational Productivity.
Source: Adopted from Altaf (2017); Wagbara (2023).

Concept of Process Innovation

Process innovation entails the refinement of the facilities, skill sets, and technologies employed in the production and distribution of goods and services (Howard, 2017). Such developments are typically less visible to the end consumer than product innovation. Process innovation, however, can also result in significant benefits such as decreased production costs, shorter cycle times, better processes and the removal of bottlenecks in the manufacturing or consumption processes. This innovation is primarily in the form of the equipment used, the technology used in product development or the operational methodology used by the workforce.

Process innovation is the application of new or substantially improved manufacturing or delivery processes for a product or service (IGI Global, 2018). In an industrial setting, this includes changes in the methods, apparatus, equipment and software employed in the transformation of inputs to outputs. It is a technique which aims at introducing new or improving existing operational procedures in the fields of manufacturing, commercial, administrative and managerial activities. It may also mean finding new ways to use the factors of production so as to improve efficiency in terms of cost, quality and service. Process modelling, optimisation and innovation have been the foundation of organisational success since the Industrial Revolution (Mathias, 2017). In today's fast-paced environment, companies need to integrate continuous process improvement into their regular business practices. Processes are the necessary means to convert corporate strategy into implementation, operational excellence and standardisation. The role of top management has changed. This requires competent leadership, as in other important sectors. It requires a clear managerial function. In this scenario, the ability to mobilise resources and build collaboration is key, making process leadership a C-level priority.

The study defines process innovation as the adoption of new or considerably enhanced manufacturing technology, service delivery channels, or product delivery techniques. The adjustments must have a tangible influence on the amount of production, quality of the product or service or costs of production and distribution to be able to qualify. The innovation must be unique to the firm; the organisation does not have to be the first developer or the first adopter of the procedure (Richard, 2016). This definition does not include purely organisational or managerial changes. Innovation in processing is viewed rather through the prism of automation equipment and integrated systems.

Equipment automation is the feature of a system in a production setting to control the industrial equipment (Howard, 2018). This involves typical activities such as validating production prerequisites (equipment readiness, data from interconnected systems), performing precise recipes with correct parameters, automatically starting up equipment if conditions are met, and terminating processes if faults are detected. Automation enables the logical execution of sequences designed by experts to manage asset utilisation, validate processes, collect reliable data, and mitigate interruptions. Automation can be classified into three categories: fixed, programmable, and flexible. Fixed automation or hard automation is the use of a production facility. The sequence of operations is fixed by the equipment setup. Programmed commands are built into the hardware of this type using cams, gears and wiring; thus it is impossible to change product styles. This structure demands a significant initial capital investment, but allows for high production

rates, making it excellent for high volume manufacturing such as automotive assembly lines or chemical processing.

Integrated processes are defined as those that combine numerous unit processes into a single piece of equipment or a set of workstations operating under a common control (National Research Council, 1995). Within unit process families, these systems may combine different processes from the same family, e.g. different material removal processes, or mix processes from other families, e.g. mass-change and structure-change processes. There are several reasons for the trend toward integrated unit processing, including decreased equipment and process costs, reduced processing times, and reduced inspection and handling requirements (National Research Council, 1995). However, integrated systems need a greater level of synthesis than that of individual unit processes (especially in situ process control). The creation of integrated processes, although fundamentally more difficult than the development of isolated unit processes, has the potential for more streamlined and more affordable manufacturing.

Concept Of Organisational Productivity

Organisational productivity is the capability of a corporation to produce the necessary output with the least amount of resources like time, capital, workers and materials. Productivity describes the relationship between the output produced and the inputs used in production (Organisation for Economic Co-operation and Development [OECD], 2001). Similarly, Mathis and Jackson (2006) defined productivity as a measure of work output as compared to the costs and human resources used. Using what assets the firm has effectively means that the firm can be more productive than its competitors and hence maintain a competitive edge. Results are the ultimate outputs expected from employees. Results can be quantified in terms of financial performance, community impact, cost-effectiveness, quality, quantity or time (McNamara, 2018). Furthermore, McNamara maintained that measuring productivity was about computing the time taken for an average employee to achieve a certain production target. This study may also document the time groups of personnel spend on various activities, such as manufacturing, travel or idle periods due to material shortages or equipment problems. This helps firms to identify and limit time spent on non-productive activity.

Brady (2016) stated that human resources are one of the most extensively monitored assets of an organisation, as many human resource (HR) systems are designed expressly to influence the productivity of individuals or groups. Performance results are directly related to key HR operations such as compensation structures, appraisal systems, training, recruitment, job design and salary. Moreover, Bernardin (2017) also argued that human resource management should encompass the management of labour costs and the enhancement of productivity by creating explicit links between compensation and results, which are vital for attaining competitive advantage. The increased focus on productivity and customer needs has also contributed to the revived interest in approaches to stimulate staff to achieve or exceed targets. Productivity is not considered in isolation, but rather is measured by its correlation with organisational performance and profitability. An example is the performance appraisal systems, which motivate employees to produce outputs that are in line with or above the set criteria. The phrases production and productivity are sometimes used interchangeably but are not the same thing. Production is the overall amount produced in a given period of time. Productivity is the amount produced in relation to the inputs used per person or system. In essence, productivity is the amount of products and services produced relative to the resources used.

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Time Minimisation: Time minimisation is the ability of an organisation to control and utilise time effectively so that activities and duties are performed with the minimum of effort and resources wasted (Wellington, 2016). The efficient use of time is a key measure of organisational productivity as it promotes operational performance, delivery and work completion. Managers who do not prioritise jobs appropriately or are distracted typically contribute to delays and inefficient work processes, which negatively affect organisational programs and productivity. Speed and time are essential resources that define organisational efficiency and competitive advantage through Time-Based Competition (TBC) (Bateman and Snell, 2015). Organisations that cut time taken to produce and deliver are better able to respond rapidly to market needs, customer requests and expectations of product delivery. Consequently, delivery time and work completion time continue to be relevant benchmarks in the evaluation of time minimisation and organisational efficiency (Bateman & Snell, 2015).

Product Quality: Product quality is the set of features and characteristics of a product or service that form its ability to satisfy stated or implied needs. The quality of the product is important in the beverage sector as it affects consumer happiness, safety and the competitiveness of the company (Aadil et al., 2019). Effective monitoring of raw materials, production processes, packaging requirements, microbial analysis and sensory evaluations such as taste, colour, aroma and texture assessment may ensure product quality. According to the International Standards Organisation, quality is the whole set of attributes and traits inherent in a product or service which enable it to achieve stated or implied customer expectations. Quality management systems and appropriate manufacturing procedures are consequently essential for guaranteeing consistent product standards and safety. Thus, product quality is an important criterion that consumers utilise in evaluating products and loyalty to manufacturing organisations.

Theoretical Review

This work is based on Person-Environment Fit Theory by Lewin and Edwards, which was popularized in 1962. The theory assumes that positive organisational outcomes occur when there is compatibility between an individual and the work environment. The theory posits that employees perform better, experience greater satisfaction, and exhibit positive work behaviours when their values, skills, and abilities align with organisational demands and culture (Abernathy & Utterback, 1978; Avila, 2014; Garcia & Calantone, 2002). Conversely, a mismatch between the person and the environment can lead to stress, low productivity, and poor organisational performance. The implication of the above theory to the relationship between process innovation and organisational productivity is that food and beverage firms achieve better time minimisation and product quality when employees' skills, values, and competencies align with innovative production processes and technologies. When workers are adequately equipped and compatible with modern operational systems, they are more capable of adapting to process innovations that improve efficiency, reduce production delays, and enhance product standards. Conversely, poor fit between employees and innovative work environments may hinder effective implementation of process innovation and reduce organisational productivity.

Empirical Review

Hang et al. (2019) investigated how management and technological innovation influence organisational performance, specifically examining the mediating effect of sustainability. Using structural equation modelling in AMOS, the authors analysed data from 304 chief executive officers and senior managers in Pakistan. Their results demonstrate that both management and technological innovations contribute positively to sustainability and organisational performance. Sustainability was found to act as a partial mediator in the relationship between these innovation types and firm performance. The study advises senior leadership to prioritise both management and technological innovation to ensure long-term sustainability and viability.

Adeyeyetolope (2014) assessed the impact of technological innovation on the performance of the manufacturing industry, with a particular focus on how strategic and marketing planning capabilities affect organisational outcomes. Through a survey of 137 employees at Nestle Foods Nigeria Plc, the researcher utilised correlation and regression

analysis, as well as analysis of variance (ANOVA), to test four hypotheses. The findings suggest that strategic planning and marketing capabilities influence organisational performance both individually and collectively. Furthermore, positive interactions were observed among various performance metrics, including resource availability, staff quality, productivity, sales revenue, financial standing, and brand reputation. The study recommended that firms embrace technological innovation to maintain market competitiveness and invest in employee training to improve overall operational effectiveness.

Moruff et al. (2018) explored the influence of service and process innovation on the internationalisation of Nigerian deposit money banks using a survey research design. The researchers administered structured questionnaires to a purposive sample of 765 staff members across five international banks, selected from a total population of 1,615 employees within the strategy and international operations departments of ten Central Bank of Nigeria-licensed international banks. Data were analysed using ordinary least squares regression through STATA 12. The findings indicate that service and process innovations significantly impact the internationalisation efforts of banks. Consequently, the authors recommended that banks aspiring to international expansion should adopt strategies focused on service and process innovation.

Ghafoor and Javed (2015) examined the effects of various innovation types—specifically product, process, marketing, and organisational innovation—on both firm and employee performance within Unilever Pakistan. Using survey data from 200 respondents in the production, research and development, and marketing departments, the authors employed factor, reliability, correlation, and regression analyses to interpret their findings. The results highlight the positive impact of these innovation types on employee performance. The study concludes by discussing theoretical and managerial implications, alongside limitations for future research.

Ojukwu et al. (2026) studied the link between process innovation and operational efficiency within food and beverage companies in Anambra State, Nigeria. The research focused on the effects of workflow automation, supply chain optimisation, customer-centric innovation, and sustainability initiatives on operational efficiency. By employing a survey design with 240 employees from 30 firms, the researchers utilised descriptive statistics and multiple regression analysis. The study found that all dimensions of process innovation examined had a significant positive impact on operational efficiency and resource utilisation. It concluded that process innovation is a primary driver of organisational productivity and competitiveness within the food and beverage sector. It recommended that managers should increase investments in process automation, optimise supply chain operations, and institutionalise sustainable production practices to improve productivity.

Iherobiem and Sanusi (2024) examined process innovation as a strategy for improving organisational performance among manufacturing firms in Nigeria. The researchers surveyed workers at Lafarge Africa Plc, Flour Mills of Nigeria and PZ Cussons, distributing 366 questionnaires and obtaining 340 usable responses. Their analyses showed a positive association between process innovation and organisational performance. They concluded that innovation in manufacturing and associated operational processes can strengthen organisational performance and competitive advantage. The authors recommended that manufacturing firms continually improve their processes and assess the efficiency of their operating activities.

Najib and Kiminami (2011) investigated innovation, cooperation and business performance among small and medium-sized food-processing enterprises in rural Indonesia. The researchers collected primary survey data from five SME clusters and analysed the results using regression, correlation and path analysis. Their findings showed that inter-firm cooperation was significantly associated with innovation and that innovation, in turn, significantly influenced business performance. The study therefore highlighted the importance of cooperation with other firms and universities in strengthening innovation and business outcomes in food-processing enterprises.

This study aimed to examine the relationship between process innovation and organisational productivity of food and beverage producing firms in Port Harcourt. The specific objectives of this study were to:

1. determine the relationship between process automation and time minimisation in food and beverage producing firms in Port Harcourt.
2. ascertain the relationship between process integration and product quality in food and beverage producing firms in Port Harcourt.

The following research questions guided the study:

1. What is the relationship between process automation and time minimisation in food and beverage producing firms in Port Harcourt?
2. How does process integration relate to product quality in food and beverage producing firms in Port Harcourt?

The following hypotheses were tested at the 0.05 level of significance:

H₀₁: There is no significant relationship between process automation and time minimisation in food and beverage producing firms in Port Harcourt.

H₀₂: There is no significant relationship between process integration and product quality in food and beverage producing firms in Port Harcourt.

Methodology

This study utilised a descriptive survey research design. The target population comprised 14 food and beverage manufacturing firms operating in Port Harcourt, Rivers State. From these organisations, a sample of 78 managerial staff was selected, including individuals in general management, sales, marketing, production, procurement, human resources, and finance. Participants were chosen based on their accessibility, proximity, availability, and functional relevance to the research. Primary data were gathered via a structured questionnaire, the "Process Innovation and Organisational Productivity Index" (PIOPI). The instrument employed a modified four-point Likert scale, ranging from "Strongly Agree" (4) to "Strongly Disagree" (1). To verify the validity of the tool, it underwent face and content assessment by two management experts. The reliability of the questionnaire was confirmed using Cronbach's Alpha, which produced a coefficient of 0.712, suggesting the instrument was appropriate for the study. Out of the 78 questionnaires distributed, 71 were successfully retrieved and deemed suitable for analysis, resulting in a 91% response rate. Descriptive statistics were employed to address the research questions, while the Spearman Rank Order Correlation Coefficient (rho) was used to test the hypotheses. All statistical procedures were conducted using SPSS Version 25, with a significance level set at 0.01.

Results

Table 1: Relationship between Process Innovation and Time Minimisation

		Process Innovation	Time Minimisation
Process Innovation	Correlation Coefficient	1.000	.644**
	Sig. (2-tailed)	.	.000
	N	71	71
Time Minimisation	Correlation Coefficient	.644**	1.000
	Sig. (2-tailed)	.000	.
	N	71	71

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

Source: Survey Data, 2026

Table 1 reveals an r value of 0.644, with a significance level of 0.000. As this value falls below the predetermined alpha threshold of 0.01, the null hypothesis (H₀₁), which posited that no significant relationship exists between process innovation and time minimisation within food and beverage manufacturing firms in Port Harcourt, is rejected, and the alternative hypothesis is accepted. Consequently, these findings indicate a statistically significant relationship between process innovation and time minimisation for the surveyed organisations.

Table 2 Relationship between Process Innovation and Product Quality

		Process Innovation	Product Quality
Process Innovation	Correlation Coefficient	1.000	.679**
	Sig. (2-tailed)	.	.000
	N	71	71
Product Quality	Correlation Coefficient	.679**	1.000
	Sig. (2-tailed)	.000	.
	N	71	71

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

Source: Survey Data, 2026

As indicated in Table 2, the r value is 0.679, with a significance level of 0.000. Because this significance level is below the established alpha threshold of 0.01, the null hypothesis (H_{02}), which proposed that there is no significant relationship between process innovation and product quality in food and beverage firms in Port Harcourt, is rejected in favour of the alternate hypothesis. This result confirms that a significant relationship exists between process innovation and product quality within these organisations.

Discussion

The analysis of the first and second hypotheses demonstrates that process innovation exerts a strong influence on organisational productivity, specifically through the enhancement of time minimisation and product quality within food and beverage manufacturing firms in Port Harcourt. This implies that managers in food and beverage producing firms have strong feeling of oneness that keeps them continuously working together, having in mind that they win and lose together, hence improving the organisational productivity through work virtualization, usage of automation equipment and integrated process. This finding is line with Howard (2017) asserted that facility and skills upgrade in a firm heightens the firm's performance and as well makes it eligible to compete favourably even in the global space across its business line. Therefore, organisations that enhance their working tools and human resource end up enhancing their productivity.

Organisations are increasingly motivated to innovate their facilities, skill sets, and production technologies as a means of improving time minimisation and product quality, thereby driving overall productivity. The evolution of techniques, machinery, equipment, and software within the transformation of inputs into outputs specifically directs firms toward the adoption of process innovation. The reason is because when a beverage organisation acquires state-of-the-art facilities, technologies, and software, and as well train its workforce to be able to proficiently use these equipment, one of the resultant effects are that there will be an improvement in their product quality and output level. Simply put, the subsequent products will be of better quality and customers will feel more satisfied with the new mode of service delivery. All of these contribute to increased time minimisation and better product quality. Nevertheless, these equipments are smart devices that could help managers in decision making and improve the productivity of their organisation. The use of automated equipment for work virtualization assist managers in analyzing large amount of data within a short time for decision making and even make valuable suggestions on how to enhance the productivity of the organisation.

Conclusion

The study concludes that a significant relationship exists between process innovation and the organisational productivity of food and beverage manufacturing firms located in Port Harcourt.

Recommendations

In light of the findings and the study's conclusions, the following recommendations are proposed:

1. Management within food and beverage manufacturing firms should adopt automation and integrate advanced technologies into their current operations to decrease reliance on manual labour, reduce error rates, and shorten production cycles, thereby improving time efficiency.
2. Management teams of food and beverage firms in Port Harcourt should implement lean manufacturing principles to identify and eliminate non-value-added activities throughout the production process, which will consequently improve product quality.

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