

# Innovations

## Analyze-Phase of Six Sigma and Performance of Manufacturing Firms in Southeast, Nigeria

Ifeyinwa Gift Akpan<sup>1</sup> Benjamin Ibe Chukwu<sup>2</sup>  
Chris Chukwuebuka Emeali<sup>3</sup> Chidinma Adanso Onyemachi<sup>4</sup>  
University of Nigeria  
Corresponding Author: Chris C. Emeali

---

**Abstract:** The study examined the analyze-phase of six sigma and performance of manufacturing firms in Southeast, Nigeria. The specific objectives were, to:(i) determine the nature of the relationship between being customer-centric and the profitability of manufacturing firms in Southeast, Nigeria; (ii) ascertain the effect of improvement process on customers repurchase behavior for products of manufacturing firms in Southeast, Nigeria; (iii) examine the nature of the relationship between eliminating waste and the quality of products in manufacturing firms in Southeast, Nigeria; (iv) investigate the extent to which leader development contribute to the reduction of expenses in manufacturing firms in Southeast, Nigeria; and (v) establish the nature of relationship between control processes and the output of manufacturing firms in Southeast, Nigeria. The population of the study was made up of 3565 members of staff comprising of management, senior and junior staff of the selected manufacturing firms in Southeast Nigeria. The sample size was three hundred and forth seven (347) respondents, which was determined using Freund and William's statistical formula. However, a total of 274 duly completed and returned copies of the questionnaire were used for the analysis. The study adopted stratified sampling technique to reach out to different strata using a structured questionnaire. To allocate samples to various strata, Bowler's (1976) proportional allocation formula for stratified sampling was used to ensure fair and equitable distribution of the sample. The research instrument was validated using face and content validity. Test retest method and Cronbach's Alpha Statistic were used to test for reliability of the instrument, of which the results were all above 70%. The primary data collected were statistically tested using regression analysis at 5% level of significance with the aid of SPSS version 23. The study found the following: (i) being customer-centric positively has a significant effect on profitability of beverage manufacturing firms in Southeast Nigeria, ( $\beta = 0.685$ ); ( $p < 0.05$ ); (ii) continuous improvement process positively has a significant effect on customers repurchase behavior, ( $\beta = 0.983$ ); ( $p < 0.05$ ); (iii) elimination of waste has a significant positive effect on quality of products, ( $\beta = 0.960$ ); ( $p < 0.05$ ); (iv) leader development has a significant positive effect on reduction of expenses, ( $\beta = 0.951$ ); ( $p < 0.05$ ); and (v) control process has a significant positive effect on organisational output, ( $\beta = 0.901$ ); ( $p < 0.05$ ). Flowing from the findings, the study therefore concluded that Analyze-Phase of Six Sigma has a significant positive effect on the performance of food and beverage manufacturing firms in Southeast Nigeria. Thus, the study, inter alia, recommended that organisations should prioritize and enhance their customer-centric culture in order to maintain and boost profitability, this is because, implementing strategies that focus on understanding and meeting customer needs, improving customer satisfaction, and fostering long-term relationships will contribute to sustained financial success.

**Keywords:** Analyze-Phase, Six Sigma, Performance, Manufacturing Firms

---

### 1.1 Introduction

In recent years, business organizations have undergone significant transformations and faced intensified competition, marked by global market fragmentation, evolving technologies, changing supplier dynamics, shifting customer demands, and the convergence of businesses (Ahmad, Othman & Lazim, 2014). These changes have direct and indirect implications for business success, leading to noticeable challenges in the dynamic and competitive global environment. The necessity of a practical and dynamic enterprise network for economic enhancement has been emphasized in current global competition and economic circumstances (Zahra & Hayton, 2006). This study focuses on the application of Six Sigma Manufacturing methodology in Southeast, Nigeria, as an approach to address challenges faced by manufacturing firms in the region.

Six Sigma, a set of production principles, is known for guiding organizations to maintain consistent production to meet the demands of target customers (Oko and Parminder, 2015). Previous research has suggested that implementing Six Sigma methodologies could enhance the performance of manufacturing firms, as seen in various products and services delivered by organizations employing these methodologies in their operations (Natarajan & Morse, 2009). Despite its successful adoption in advanced countries, the utilization of Six Sigma in African nations, including Southeast Nigeria, remains a topic of interest and relevance. Industrial activities in Southeast Nigeria, particularly within the food and beverage sector, have witnessed increased competition, prompting many firms to adopt Six Sigma to streamline production processes and enhance their market positioning. However, amid the numerous manufacturing firms in the region, distinguishing those that have adopted Six Sigma from those using alternative methods like ISO 9001 in terms of performance, market gain, and business growth remains challenging (Nnabuiife & Ohue, 2021; Zhou, Ayegba, Ayegba, Ayegba, & Jie, 2021).

This study aims to evaluate the Analyze phase of Six Sigma and its effect on the performance of food and beverage manufacturing firms in Southeast Nigeria. The focus is on understanding how the failure to adopt unique manufacturing techniques and quality assurance methodologies has affected the performance of these firms, leading to their inability to measure up to international standards (Nnabuiife & Ohue, 2021). The research also addresses the gap in understanding the benefits of Six Sigma methodologies among Nigerian manufacturing firms, which has resulted in outcomes below expectations (Umude-Igbru and Brian, 2015). Poor performance in the food and beverage manufacturing sector in Southeast Nigeria has been attributed to various factors, including a lack of customer focus, low continuous improvement processes, failure to eliminate waste, inadequate leader development, and control processes, outdated technologies, and insufficient application of modern management techniques (Onwughalu, Okeke, and Henry-Chibor, 2017). Thus, the goal of the study is to provide insights into the factors affecting profitability, customer repurchases, product quality, expenses, and overall output in the food and beverage manufacturing sector in the region. To achieve the above objectives, the following questions were formulated to guide the study:

- RQ1: What is the nature of the relationship between being customer-centric and the profitability of manufacturing firms in Southeast, Nigeria?
- RQ2: How does the continuous improvement process influence customers repurchase behavior for products of manufacturing firms in Southeast, Nigeria?
- RQ3: What is the nature of the relationship between eliminating waste and the quality of products in manufacturing firms in Southeast, Nigeria?

- RQ4: To what extent does leader development contribute to the reduction of expenses in manufacturing firms in Southeast, Nigeria?
- RQ5: What is the relationship between control processes and the output of manufacturing firms in Southeast, Nigeria?

By exploring the five questions above, the study aims to enrich our understanding of the “analyse-phase of six sigma model” in the following ways. First, the investigation into the relationship between being customer-centric and the profitability of manufacturing firms in Southeast, Nigeria (RQ1) contributes to knowledge by offering insights into the specific dynamics that link customer-centric practices to financial success. Understanding the relationship between continuous improvement processes and customers repurchase behavior (RQ2) provides valuable knowledge for businesses aiming to enhance consumer loyalty through enhancement of operational efficiency. Examining the nature of the relationship between waste elimination and product quality in manufacturing firms in Southeast, Nigeria (RQ3) adds to the existing body of knowledge on production optimization. The exploration of leader development's extent of contribution to expense reduction in manufacturing firms (RQ4) offers insights into strategic areas for leadership development with significant cost-saving implications. Investigating the relationship between control processes and output in manufacturing firms in Southeast, Nigeria (RQ5) contributes valuable knowledge for optimizing operational strategies and improving overall productivity and performance. The structure of the study is as follows: First, after the introductory part which dealt with the general background/problem statement/ research question, the study discusses the literature and arguments around “analyse-phase of six sigma model.”Second, the study describes the methodology adopted. Thirdly, it presents the data analysis. Fourth, the study presents results and discussion of findings and finally, conclusion and recommendations.

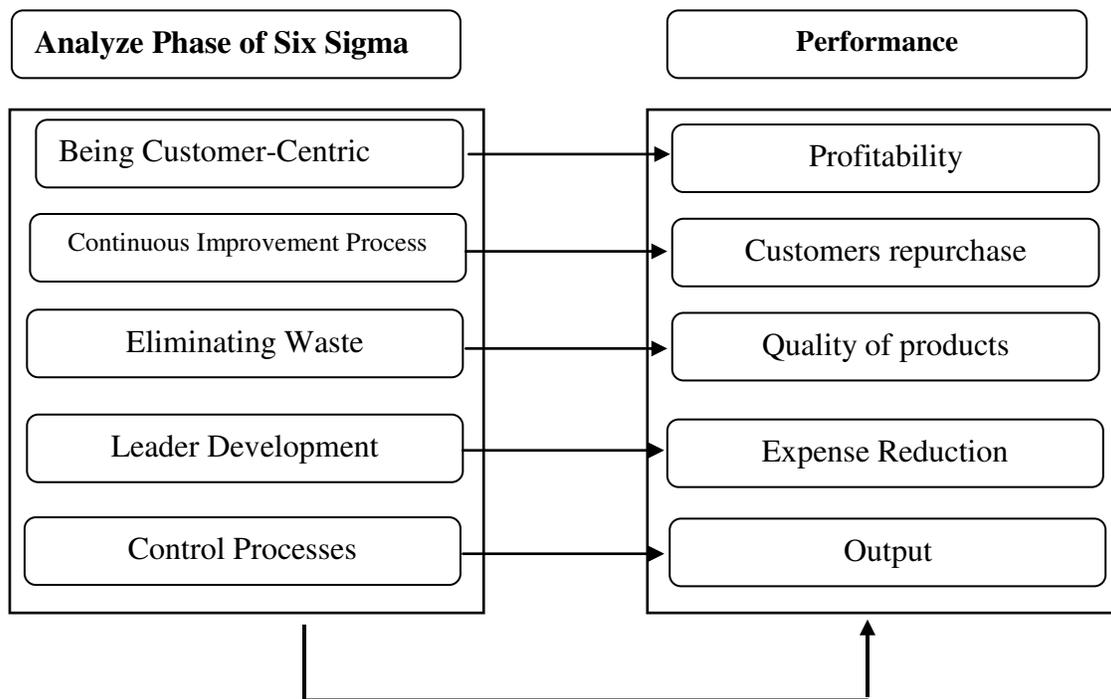
## 2.0 Literature Review

Six Sigma provides a comprehensive framework as a systematic problem-solving approach focused on defect elimination and variation reduction, ultimately leading to process improvement (Hessing, 2023). The DMAIC methodology, a principal tool in Six Sigma, is highlighted as a logical framework for planning and implementing process improvements to achieve a Six Sigma level of excellence. The literature emphasizes Six Sigma's role in making business processes more efficient and effective through statistical tools, defect elimination, and continuous process improvement (CFI Team, 2023).The term "Six Sigma" is derived from statistical concepts, where sigma represents the standard deviation from the center, indicating an extremely low defect rate. Extant literature underscores Six Sigma's goal of achieving nearly perfect quality, with only 3.4 defects per million opportunities. It is highlighted that Six Sigma can be applied to any industry or process, creating a management system for identifying and eliminating errors to maximize benefits for customers (Pankaj, 2023).The development of Six Sigma by Motorola in the 1980s is acknowledged, with subsequent adoption by major companies worldwide, including General Electric, Toyota, and Amazon. The disciplined and data-driven approach of Six Sigma is outlined as a methodology widely used in project management to minimize defects and achieve process improvement. The literature also introduces the concept of Lean Six Sigma, combining Six Sigma methods with lean manufacturing principles to minimize waste and optimize resources (Adam, 2023).

Extant literature delves into Six Sigma as a business methodology for quality improvement, aiming to systematically eliminate defects in a process(McLaughlin, 2023). The term "Sigma" is explained as a symbol for standard deviation, emphasizing the statistical basis of Six Sigma. The benefits attributed to Six Sigma include process cost reduction, cycle-time improvement, waste reduction, enhanced customer satisfaction,

and more reliable products and services. Extant literature also suggests that the success of implementing Six Sigma relies on making a compelling case for statistical tools, gaining stakeholder buy-in, and focusing on limiting fluctuations within business processes (McLaughlin, 2023). The concept of Six Sigma is described as emphasizing quality improvement by reducing errors in processes, products, or services. The literature highlights the focus on reducing variation to improve productivity and profitability, with the ultimate goal of delivering defect-free products and services. Three key methods associated with Six Sigma—DMAIC, process management, and Design for Six Sigma (DFSS)—are introduced, providing an organized approach to problem-solving (Drmahey, 2018).

The Analyze phase of DMAIC represents the third phase where root causes of problems are identified through statistical tools and analysis of the process. Various tools such as Pareto diagrams, cause-and-effect analysis, five why analysis, and failure modes and effects analysis are highlighted for determining root causes during the Analyze phase. The importance of this phase in understanding the problem's underlying causes and developing effective solutions is emphasized (Hessing, 2023). It highlights the importance of statistical tools, defect elimination, and continuous improvement in achieving high-quality processes and products. The emphasis on the Analyze phase underlines the significance of thorough analysis in identifying root causes for effective problem-solving and process improvement.



**Figure 1: Conceptual Framework**

*Source: Authors Design*

### **2.1 Being Customer-Centric and Profitability**

Hamilton-Ibama and Owuso (2022) explored the nexus between Pricing Strategy and Customer Loyalty among food and beverage manufacturing firms. Uncovering a robust positive relationship, the study underscored the pivotal role of effective pricing strategies in fostering customer loyalty and commitment. Meanwhile, Wanjiku and Muli (2022) investigated the Influence of Supplier Relationship Management on the Performance of Food and Beverage Manufacturing Firms in Kenya. The study identified positive impacts stemming from supplier segmentation, information flow, collaboration, and development, all contributing to enhanced performance. Ogonu and Ihunwo (2022) probed into the realm of Price Fairness and Customer Loyalty within the Food and Beverage Industry in Port Harcourt, unveiling a significant positive relationship between price fairness and customer loyalty, highlighting the importance of fair pricing in cultivating customer loyalty. In South East Nigeria, Ugwu, Eneh, and Orga (2023) centered their study on the Effect of Corporate Culture on the Profitability of Food, Beverages, and Tobacco Manufacturing Firms. Learning and development, communication, and trust emerged as key components with positive and significant effects on revenue increase, productivity change, and reduced expenses, prompting the recommendation of strategic quality planning and customer-centric approaches for improved profitability. Lastly, Hanmaikyur, Kwahar, Umogbai, Adudu, and Torough (2023) delved into Competitive Intelligence and Competitiveness among Quoted Foods and Beverages Manufacturing Firms in Nigeria. The study found positive and significant effects of customer intelligence, marketing intelligence, competitor intelligence, and product intelligence on competitiveness, emphasizing the critical role of competitive intelligence in enhancing the competitive stance of firms in the industry.

### **2.2 Continuous Improvement Process and Customers Repurchase Behavior**

Extant literatures in the subject matter collectively offer valuable insights into diverse aspects of customer behavior, service quality, and organizational performance across different industries (Kim and Hyun, 2022; Nganga and Nyaga, 2022; Severesia, Utomo, and Natalia, 2022; Wuanor and Eke, 2022; Chendo, 2023; Lee and Lee, 2023; Villanueva, Alejandro, and Ga-an, 2023). Kim and Hyun's analysis of psychological variables influencing customer participation and repurchase intentions underscores the significance of customer tolerance developed through participation behavior (Kim and Hyun, 2022). Nganga and Nyaga's research on continuous improvement practices in manufacturing highlights the importance of evidence-based decision-making, customer focus, process approach, and employee engagement for organizational success (Nganga and Nyaga, 2022). Severesia, Utomo, and Natalia's study sheds light on factors impacting repurchase intention in the beverage manufacturing industry, emphasizing the role of customer experience and loyalty in the B2B sector (Severesia, Utomo, and Natalia, 2022). Wuanor and Eke's investigation into the flour mill industry in Nigeria reveals a positive correlation between service quality dimensions and customer satisfaction, with practical recommendations for employee training and service improvement (Wuanor and Eke, 2022). Chendo's study on fast-food outlets in Akwa Metropolis emphasizes the significant impact of customer service and experience on profitability, urging the prioritization of existing customer relationships (Chendo, 2023). Lee and Lee's research on sustainable golf course management identifies the positive effects of service quality on customer loyalty, employing a mixed methods approach (Lee and Lee, 2023). Villanueva, Alejandro, and Ga-an's study during the COVID-19 pandemic highlights the resilience of fast-food restaurants in meeting customer expectations, despite challenges, while suggesting a need for innovative strategies (Villanueva, Alejandro, and Ga-an, 2023).

### **2.3 Elimination of Waste and Quality of Products**

Okunuga, Amos-Fidelis, and Dogo (2022) study on green manufacturing in Lagos State's fast-moving consumer goods companies highlighted the positive effects of green efficient processes and green recycling on operational costs. Ugwu and Orga (2022) delved into the relationship between organizational structure and productivity in South East Nigeria's food, beverage, and tobacco manufacturing firms, revealing significant correlations between task allocation, coordination mechanisms, employee safety cost, and various performance metrics. Okolocha&Anugwu (2022) examination of lean manufacturing in Anambra State's pharmaceutical companies affirmed its positive effects on operational efficiency and competitiveness. Mohammed and Usman's (2022) literature review on lean manufacturing deployment in Nigerian SMEs outlined the prospects and challenges these enterprises face, emphasizing the potential for successful lean initiatives. Vyas, Makinde, Akinlabi, &Adefulu (2023) investigation into quality management practices in Lagos State's food and beverage manufacturing firms demonstrated their significant positive impact on productivity. These studies collectively contribute to the understanding and advancement of manufacturing practices, from TQM and lean methodologies to sustainability, organizational structure, and quality management, providing a comprehensive overview of their implications for various sectors in the manufacturing industry.

### **2.4 Leader Development and Reduction of Expenses**

The investigation into the relationship between leader development and expenses reduction is informed by various studies in the context of food and beverage industries. Abhimanyu, Akshay, and Abhishek's (2020) study on cost cutting in the food and beverage service department emphasizes the importance of staff training and development for effective cost control. Similarly, Toong, Wong, and Vasudevan's (2022) research on leadership styles in the Malaysian food and beverage service industry demonstrates that leadership styles significantly influence company performance. In the context of organizational structure, Ugwu and Orga (2022) find that task allocation, coordination mechanisms, and employee safety cost correlate with cost reduction in the food, beverage, and tobacco manufacturing firms. These findings underscore the relevance of leadership and organizational structure in influencing operational efficiency, costs, and overall performance in the food and beverage sector. The synthesis of these studies provides valuable insights into the multifaceted relationship between leader development, organizational dynamics, and the financial aspects of food and beverage businesses.

### **2.5 Control Processes and Output**

The examination of the relationship between control processes and output in the context of food and beverage manufacturing firms draws insights from various studies. Muhammad (2014) study on sustainability reporting in Nigerian food and beverage firms reveals that sustainability disclosures, constituting about two percent of annual reports, are influenced by the size of the firms, with larger firms disclosing relatively less sustainable information. Nnaji-Ihedinmah and Ugwu (2016) study on occupational health and safety management in plastics manufacturing emphasizes the identification and management of various hazards for effective control. Additionally, Worlu and Somiari (2017) investigation into operations planning and capacity utilization in food and beverage firms establishes a positive correlation between operations planning and capacity utilization. Folorunso and Sajuyigbe (2018) study on ownership structure highlights that managerial ownership, institutional ownership, government ownership, and family ownership have no significant influence on organizational performance, but foreign ownership does. Uko (2018) research on quality management practices in Port Harcourt's food and beverage firms underscores the positive impact of strategic quality planning and customer focus on performance. Furthermore, Andow, Dabo, and Ekeh (2018) study on outsourcing in Nigerian food and beverage firms reveals that business process

outsourcing and knowledge process outsourcing positively impact organizational performance. Owusu-Mensah (2020) analysis of production system management in Ghana's food and beverage industry emphasizes spare part inventory control, production quality, and maintenance modeling. Akpa, Babatunde, Asikhia and Nnorom (2020) exploration of knowledge management in Nigerian food and beverage firms indicates that knowledge creation and sharing affect innovation and job satisfaction. Irene and Deusdedita (2022) investigation into inventory control management systems in Tanzania's manufacturing industry highlights the positive impact of such systems on organizational performance. Hamilton, Edith-Onajite, and Owuso (2022) study on pricing strategy and customer loyalty in Port Harcourt's food and beverage firms establishes a strong positive relationship between pricing strategy and customer loyalty. Nyamah, Opoku, and Kaku (2022) research on inventory strategies in Ghana's food and beverage processing industries demonstrates that economic order quantity and strategic supplier partnership significantly influence operational performance. Iyke and Onuoha (2023) study on organizational structural typology in Abia State, Nigeria, reveals a connection between organizational structural typology and the performance of food and beverage firms. Lavorato and Piedepalumbo (2023) case study on smart technologies' impact on decision-making and control systems in food and beverage companies underscores the transformative potential of digitalization in enhancing efficiency and sustainability. Overall, these studies collectively contribute valuable insights into the dynamics of control processes and their impact on output within the food and beverage industry.

### **3.0 Methodology**

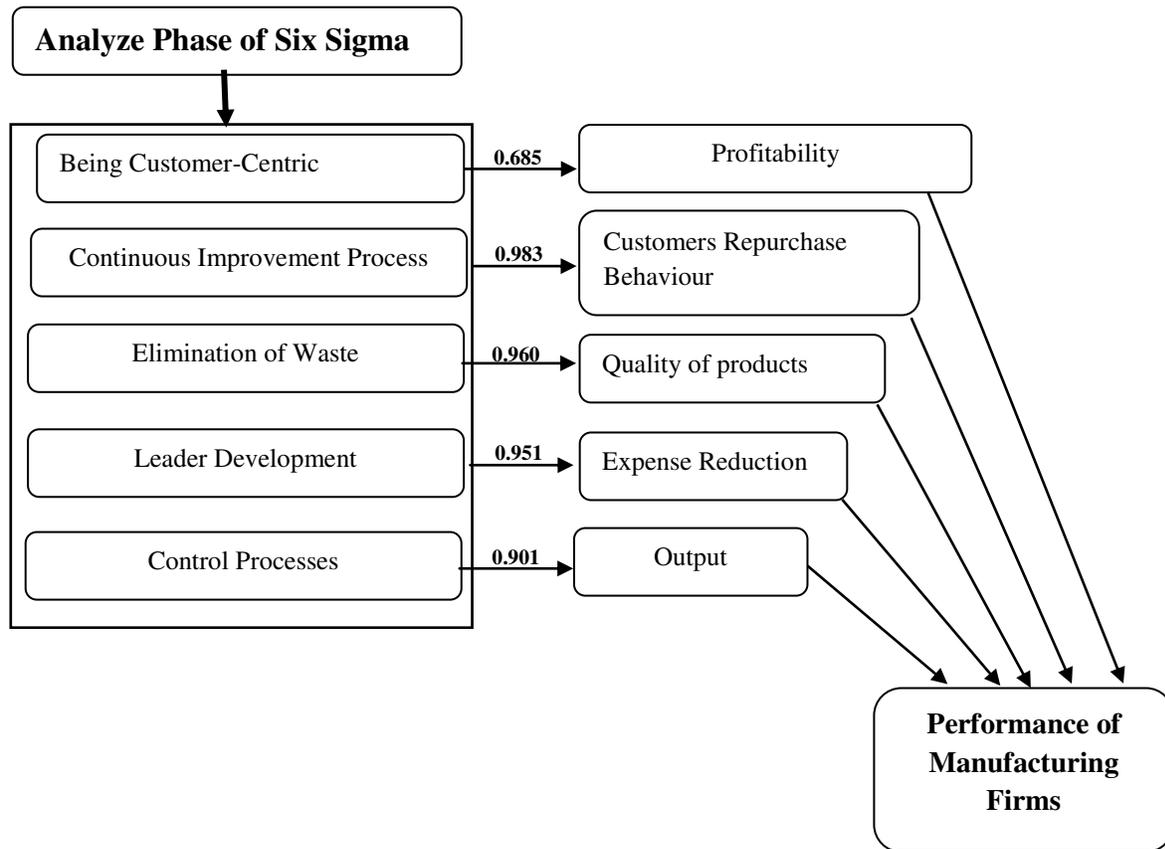
Survey research design was adopted for the study. The population of the study was made up 3565 members staff comprising of management, senior and junior staff of the selected manufacturing firms in Southeast Nigeria. The sample size was three hundred and forth seven (347) respondents, which was determined using Freund and William's statistical formula. However, a total of 274 duly completed and returned copies of the questionnaire were used for the analysis. Others were either not returned or badly completed. The study adopted stratified sampling technique to reach out to different strata using a structured questionnaire. To allocate samples to various strata, Bowler's (1976) proportional allocation formula for stratified sampling was used to ensure fair and equitable distribution of the sample. The research instrument was validated using face and content validity. Test retest and Cronbach's Alpha Statistic were used to test for reliability of the instrument, of which the results were all above 70%. The primary data collected were statistically tested using regression analysis at 5% level of significance with the aid of SPSS version 23.

## **4.0 Results and Discussion**

### **4.1 Results/ Implication**

Being Customer-Centric positively has a significant effect on Profitability of beverage manufacturing firms in Southeast Nigeria, ( $\beta = 0.685$ ); ( $p < 0.05$ ), which implies that organisations that are customer-centric in their operations will maintain a considerable profitability in the industry. Continuous Improvement Process positively has a significant effect on Customers Repurchase Behavior, ( $\beta = 0.983$ ); ( $p < 0.05$ ), which implies that organisations that continuously improve their process and product enhance consumer loyalty through operational efficiency. Elimination of Waste has a significant positive effect on Quality of Products, ( $\beta = 0.960$ ); ( $p < 0.05$ ), which implies that organisations that eliminate unnecessary wastages enhance production optimization. Leader Development has a significant positive effect on Reduction of Expenses, ( $\beta = 0.951$ ); ( $p <$

0.05), which implies that organisations that raise leaders that transform the business space reduces benefit to a large extent with significant cost-saving implications. Control Processes has a significant positive effect on organisational Output, ( $\beta = 0.901$ ); ( $p < 0.05$ ), which implies that organisations that have a robust control process enhance and optimize operational strategies, improving overall productivity and performance to a large extent.



**Figure 2: Conceptual Framework showing the Result**

*Source: The Authors*

## 4.2 Discussion

### 4.2.1 Being Customer-Centric and Profitability

The findings on the positive effect of being customer-centric on the profitability of beverage manufacturing firms in Southeast Nigeria ( $\beta = 0.685$ ;  $p < 0.05$ ) aligns with several previous research findings. Hamilton-Ibama and Owuso (2022) revealed a robust positive relationship between effective pricing strategies and customer loyalty, emphasizing the role of customer-focused pricing decisions. Wanjiku and Muli (2022) investigation highlighted the positive impacts of supplier relationship management on the performance of

food and beverage manufacturing firms, emphasizing the importance of collaboration with external partners. Ogonu and Ihunwo (2022) established a significant positive relationship between price fairness and customer loyalty, underscoring the importance of fair pricing practices in cultivating customer loyalty. The study by Ugwu, Eneh, and Orga (2023) emphasized the positive effects of corporate culture components on profitability, suggesting that a customer-centric corporate culture contributes to revenue increase and reduced expenses. Furthermore, Hanmaikyur et al. (2023) found positive and significant effects of customer intelligence, marketing intelligence, competitor intelligence, and product intelligence on competitiveness, highlighting the critical role of competitive intelligence in enhancing the competitive stance of firms in the industry. Collectively, these findings underscore the interrelated ways in which customer-centric approaches contribute to the overall success and profitability of food and beverage manufacturing firms.

#### **4.2.2 Continuous Improvement Process and Customers Repurchase Behavior**

The findings on the positive and significant effect of Continuous Improvement Process on Customers Repurchase Behavior ( $\beta = 0.983$ ;  $p < 0.05$ ) align with and complement the insights from various previous studies. Kim and Hyun (2022) emphasize the importance of customer tolerance developed through participation behavior, suggesting that continuous improvement processes may contribute to enhancing customer tolerance and, consequently, repurchase intentions. Nganga and Nyaga (2022) exploration of continuous improvement practices in manufacturing underscores the relevance of evidence-based decision-making, customer focus, and employee engagement for organizational success, providing a context for understanding the positive impact of such practices on customer repurchase behavior. Severesia, Utomo, and Natalia (2022) study on factors influencing repurchase intention in the beverage manufacturing industry aligns with the current findings, highlighting the crucial role of customer experience and loyalty. Wuanor and Eke (2022) research in the flour mill industry, emphasizing the positive correlation between service quality dimensions and customer satisfaction, supports the notion that continuous improvement processes positively influence customer perceptions and repurchase behavior. Chendo (2023) focus on fast-food outlets in Akwa Metropolis reinforces the significance of customer service and experience, echoing the idea that a commitment to continuous improvement can impact profitability through enhanced customer relationships. Additionally, Lee and Lee (2023) research on sustainable golf course management and Villanueva, Alejandro, and Ga-an(2023) study during the COVID-19 pandemic both underscore the positive effects of service quality and innovative strategies on customer loyalty, aligning with the notion that continuous improvement processes contribute to long-term customer relationships and repurchase behavior. Overall, these studies collectively highlight the ways in which continuous improvement processes positively influence customer repurchase behavior across diverse industries.

#### **4.2.3 Elimination of Waste and Quality of Products**

The findings regarding the significant positive effect of Elimination of Waste on the Quality of Products ( $\beta = 0.960$ ;  $p < 0.05$ ) align with and complement the insights from several previous studies. Okunuga, Amos-Fidelis, and Dogo (2022) study on green manufacturing in fast-moving consumer goods companies in Lagos State highlights the positive effects of green efficient processes and recycling on operational costs, suggesting a parallel with the current findings where waste elimination contributes to enhanced production optimization and, consequently, product quality. Ugwu and Orga (2022) exploration of the relationship between organizational structure and productivity in South East Nigeria's manufacturing firms supports the notion that efficient organizational processes, including waste elimination, correlate with improved performance metrics, emphasizing the broader implications of such practices on overall productivity. Okolocha&Anugwu (2022) examination of lean manufacturing in pharmaceutical companies in Anambra State aligns with the current findings, affirming the positive effects of lean methodologies on operational

efficiency, which can directly impact product quality and competitiveness. Mohammed and Usman (2022) literature review on lean manufacturing deployment in Nigerian SMEs further underscores the potential for successful waste elimination initiatives to enhance overall manufacturing efficiency and quality. Additionally, Vyas, Makinde, Akinlabi, & Adefulu (2023) investigation into quality management practices in food and beverage manufacturing firms in Lagos State aligns with the current findings, demonstrating the significant positive impact of quality management on productivity, further reinforcing the importance of waste elimination for product quality. Collectively, these studies contribute to a comprehensive understanding of manufacturing practices, emphasizing the critical role of waste elimination in optimizing production processes and ensuring the quality of products across diverse sectors in the manufacturing industry.

#### **4.2.4 Leader Development and Reduction of Expenses**

The findings regarding the significant positive effect of Leader Development on the Reduction of Expenses ( $\beta = 0.960$ ;  $p < 0.05$ ) align with and build upon insights from various studies within the food and beverage industries. Abhimanyu, Akshay, and Abhishek (2020) emphasis on staff training and development for effective cost control in the food and beverage service department resonates with the current findings, highlighting the positive impact of leader development on cost-saving measures. Additionally, Toong, Wong, and Vasudevan (2022) research on leadership styles in the Malaysian food and beverage service industry further supports the connection between leadership development and company performance, reinforcing the idea that effective leadership can contribute to cost reduction. In the organizational structure context, Ugwu and Orga (2022) findings on task allocation, coordination mechanisms, and employee safety cost correlating with cost reduction in the food, beverage, and tobacco manufacturing firms align with the current study, emphasizing the broader implications of effective leadership development and organizational dynamics on operational efficiency and expense reduction. These collective insights underscore the multifaceted relationship between leader development, organizational dynamics, and financial aspects in the food and beverage sector, providing valuable considerations for businesses aiming to optimize operational efficiency and reduce expenses through investing in leadership development initiatives.

#### **4.2.5 Control Processes and Output**

The findings on the significant positive effect of Control Processes on organizational Output ( $\beta = 0.960$ ;  $p < 0.05$ ) align with and draw support from a range of previous studies in the context of food and beverage manufacturing firms. Muhammad (2014) study on sustainability reporting in Nigerian food and beverage firms, Nnaji-Ihedinmah and Ugwu (2016) exploration of occupational health and safety management in plastics manufacturing, and Worlu and Somiari (2017) investigation into operations planning and capacity utilization all contribute to the understanding that effective control processes, whether in sustainability reporting, hazard management, or operations planning, positively influence organizational performance and output. Folorunso and Sajuyigbe (2018) study on ownership structure, Uko (2018) research on quality management practices, and Andow, Dabo, and Ejeh (2018) study on outsourcing provide additional perspectives, showing that various facets of organizational control, including ownership structure, quality management, and outsourcing practices, impact overall performance positively. The collective insights from studies on inventory control management systems (Irene and Deusdedita, 2022), pricing strategy and customer loyalty (Hamilton, Edith-Onajite, and Owuso, 2022), knowledge management (Akpa, Babatunde, Asikhia, and Nnorom, 2020), inventory strategies (Nyamah, Opoku, and Kaku, 2022), organizational structural typology (Iyke and Onuoha, 2023), and smart technologies' impact (Lavorato and Piedepalumbo, 2023) further emphasize the broader influence of control processes on various aspects of organizational

performance and output within the food and beverage industry. These collective findings highlight the integral role of robust control processes in enhancing and optimizing operational strategies, ultimately leading to improved overall productivity and performance in the food and beverage manufacturing sector.

## **5.0 Conclusion and Recommendation**

### **5.1 Conclusion**

Flowing from the findings, the study therefore concluded that Analyze-Phase of Six Sigma has a significant positive effect on the performance of food and beverage manufacturing firms in Southeast Nigeria.

### **5.2 Recommendation**

**5.2.1** Organisations should prioritize and enhance their customer-centric culture in order to maintain and boost profitability. Implementing strategies that focus on understanding and meeting customer needs, improving customer satisfaction, and fostering long-term relationships will contribute to sustained financial success. This may involve investing in customer relationship management (CRM) systems, obtaining customer feedback, and aligning products and services with customer preferences.

**5.2.2** Organizations should adopt a culture of continuous improvement in their processes and products to enhance customer loyalty and operational efficiency. They should regularly assess and refine operational processes, product quality, and customer experiences; and implementing methodologies such as Lean or Six Sigma can help identify areas for improvement, reduce inefficiencies, and promote innovation. A commitment to continuous improvement not only strengthens customer repurchase behavior but also ensures adaptability in a dynamic market.

**5.2.3** Firms should prioritize waste elimination initiatives to enhance production optimization and product quality; and conduct thorough assessments of production processes to identify and eliminate unnecessary wastages. This may involve implementing lean manufacturing principles, optimizing supply chain processes, and investing in technologies that minimize resource wastage. By doing so, organizations can not only improve the quality of their products but also achieve cost savings through efficient resource utilization.

**5.2.4** Organizations should invest in the development of leaders who can transform the business space and contribute to significant cost savings; implement leadership development programs that focus on strategic decision-making, effective cost control, and innovative problem-solving; and empower leaders to create a culture of efficiency, encourage cost-conscious decision-making, and drive initiatives that contribute to the reduction of expenses while maintaining or enhancing overall organizational performance.

**5.2.5** Companies should establish and maintain robust control processes to optimize operational strategies and improve overall productivity and performance; and implement effective control mechanisms across various organizational functions, such as production, finance, and supply chain. Invest in technologies that facilitate real-time monitoring, reporting, and decision-making. By ensuring a strong control framework, organizations can enhance efficiency, reduce errors, and achieve better organizational output, contributing to overall success in the competitive landscape.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### ORCID IDs

1. Ifeyinwa Gift Akpan: ORCID.0009-0004-7493-2828
2. Chris Chukwuebuka Emeali: ORCID.0009-0003-7253-823X
3. Chidinma Adanso Omyemachi: ORCID.0000-0002-3013-833X

### References

2. *Abhimanyu, A., Akshay, N., & Abhishek, R. (2020). A Study on Cost Cutting & Control in Food & Beverage Service Department. International Journal of Scientific & Technology Research, 9(2), 1717-1719.*
3. *Adam, H. (2023). What Is Six Sigma? Concept, Steps, Examples, and Certification. Retrieved from www.investopedia.com*
4. *Ahmad, N., Othman, S. N., & Lazim, H. M. (2014). A review of technological capability and performance connection in manufacturing companies. 2014 International Symposium on Technology Management and emerging technologies (ISTMET 2014).*
5. *Akpa, V. O., Babatunde, H. A., Asikhia, P. T., & Nnorom, G. K. (2020). Knowledge Management and Performance of Organizations: A Case Study of Selected Food and Beverage Firms. International Journal of Economics and Business Administration, VIII(3), 2241-4754.*
6. *Andow, A. A., Dabo, Z., & Ejeh, E. C. (2018). Impact of Outsourcing on Organizational Performance of Listed Food and Beverages Firms in Nigeria. LASU Journal of Employment Relations & Human Resource Management, 1(1), 156-166.*
7. *Chendo, N. A. (2023). Effect of Customer Satisfaction on the Profitability of Fast Food Outlets in Akwa Metropolis of Anambra State. British Journal of Marketing Studies, 11(1), 2053-4051.*
8. *Folorunso, O. O., & Sajuyigbe, A. S. (2018). Ownership Structure and Organizational Performance: An Investigation of Food and Beverage Companies in Nigeria. Socialsci Journal, 2, 2581-6624.*
9. *Hamilton, I., Edith-Onajite, L., & Owuso, S. M. (2022). Pricing strategy and customer loyalty of food and beverages manufacturing firms in Port Harcourt, Nigeria. Academicia an International Multidisciplinary Research Journal, 12(3), 2249-7137.*
10. *Hanmaikyur, T. J., Kwahar, N., Umogbai, M. E., Adudu, C. A., & Torough, S. M. (2023). Competitive Intelligence and Competitiveness of Quoted Foods and Beverages Manufacturing Firms in Nigeria. International Journal of Business Systems and Economics, 13(3), 2360-9923.*
11. *Irene, O. M., & Deusdedita, L. (2022). Effects of Inventory Control Management Systems on Organization Performance in Tanzania Manufacturing Industry- A Case Study of Food and Beverage Manufacturing Company in Mwanza City. International Journal of Engineering, Business and Management, 6(2), 2456-8678.*
12. *Iyke A. A. & Onuoha B. C. (2023) Organisational Structural Typology and Performance of Food and Beverage Firms in Abia State, Nigeria. Academia Networks International Journal of Management Studies, 8(4):6722-219X.*

13. Kim, S. J., & Hyun, B. H. (2022). *Effects of Psychological Variables on the Relationship between Customer Participation Behavior and Repurchase Intention: Customer Tolerance and Relationship Commitment*. *Economies*, 10(12), 305.
14. Lavorato, D., & Piedepalumbo, P. (2023). *How Smart Technologies Affect the Decision-Making and Control System of Food and Beverage Companies: A Case Study*. *Sustainability*, 15(5), 4292.
15. Lee, H. J. A. (2020). *Study of Consumer Repurchase Behaviors of Smartphones Using Artificial Neural Network*. *Information*, 11(9)..
16. Mohammed, I., & Usman, A. (2022). *Prospects and Challenges of Lean Manufacturing Deployment within Manufacturing SMEs in Nigeria: A Literature Review*. *Journal of Social Sciences and Management Studies*.
17. Muhammad, A. I. (2014). *Sustainability Reporting among Nigeria Food and Beverages Firms*. *International Journal of Agriculture and Economic Development*, 2(1), 1-9.
18. Natarajan, R. N., & Morse, J. (2009). *Six Sigma in services: Challenges and opportunities*. *International Journal of Productivity and Quality Management*, 4(5-6), 658-675.
19. Nganga, G. N., & Nyaga, J. (2022). *Continuous improvement practices and organizational performance of large manufacturing companies in Kenya: A case study of Nairobi Bottlers Limited*. *International Academic Journal of Innovation, Leadership, and Entrepreneurship*, 2(3).
20. Nnabuife, E. I., & Ohue, P. I. (2021). *Six Sigma Manufacturing and Performance of Brewing Firms in South-South, Nigeria*. *European Journal of Business and Innovation Research*, 9(4), 41-55.
21. Nnaji-Ihedinmah, N. C., & Ugwu, K. E. (2016). *Evaluating Occupational Health and Safety Management in Selected Plastics Manufacturing Organizations in Awka Metropolis, Nigeria*. *Management Studies and Economic Systems*, 3(1), 23-33.
22. Nyamah, E. Y., Opoku, R. K., & Kaku, G. (2022). *Inventory strategies and performance of food and beverage processing industries*. *International Journal of Logistics Systems and Management*, 41(1/2), 120-144.
23. Ogonu, G. C., & Ihunwo, E. C. (2022). *Price Fairness and Customer Loyalty of Food and Beverage Industry in Port Harcourt*. *Nigerian Journal of Management Sciences*, 23(2), 256-265.
24. Oko, A., & Parminder, S. K. (2015). *Lean Six Sigma Approach to Improve the Admissions Process for a Nigerian HE Institute*. *International Journal of Scientific & Engineering Research*, 6(5), 22-29.
25. Okolocha, C. B., & Anugwu, C. C. (2022). *Lean Manufacturing Approach and Operational Efficiency of Nigerian Pharmaceutical Companies in Anambra State*. *Saudi Journal of Business and Management Studies*, 7(3), 2415-6671.
26. Okunuga, A. M., Amos-Fidelis, N. B., & Dogo, E. B. (2022). *Green Manufacturing and Operational Cost of Selected Fast-Moving Consumer Goods Companies in Lagos State, Nigeria*. *European Journal of Business and Innovation Research*, 10(5), 2053-4027.
27. Onwuzu, K. C., Nnamani, E., & Okonkwo, A. O. (2023). *Globalisation and Development of Manufacturing Organisations in South East Of Nigeria*. *Advance Journal of Management and Social Sciences*, 7(1).
28. Owusu-Mensah, D. (2020). *Analysis of Production System Management of Ghana's Food and Beverage Industry: Empirical evidence from Spare Parts Inventory Control, Production Quality and Maintenance Modeling*. *Journal of Food Industry*, 4(1), 1948-545X.
29. Owusu-Mensah, D., Naifei, R., Brako, L., & Boateng, P. (2020). *Analysis of Production System Management of Ghana's Food and Beverage Industry: Empirical evidence from Spare Parts Inventory Control, Production Quality and Maintenance Modeling*. *Journal of Food Industry*, 4(1)..
30. Pankaj, K. (2023). *What is Six Sigma: Everything You Need to Know About It*. *Simplilearn*. [www.simplilearn.com](http://www.simplilearn.com)

31. Severesia, C., Utomo, P., & Natalia, F. (2022). *Investigating Factors Influencing Repurchase Intention: Case Study in Beverage Manufacturing Industry*. *Business Excellence and Management*, 12(1).
32. Toong, H., Wong, W. Y., & Vasudevan, A. (2022). *The Influence of Leadership Style on Company Performance in Food and Beverage Service Industry of Malaysia*. *Seybold Report*, 17(8).
33. Ugwu, F. I., Eneh, E. O., & Orga, J. I. (2023). *Effect of Corporate Culture on the Profitability of Food Beverages and Tobacco Manufacturing Firms in South East Nigeria*. *Advance Journal of Management, Accounting and Finance*, 8(4).
34. Ugwu, F., & Orga, C. (2022). *Organizational Structure and Productivity of Food, Beverage and Tobacco Manufacturing Firms in South East, Nigeria*. *Saudi Journal of Business and Management Studies*, 7(2).
35. Uko, R. (2018). *Quality Management Practices and Performance of Food and Beverages Firms in Port Harcourt*. *International Journal of Advanced Academic Research: Social & Management Sciences*, 4(1).
36. Umude-Igbu, O., & Brian, P. (2015). *Acceptability of lean six sigma in a developing economy: results from exploratory research in Nigerian consulting companies*. *Proceedings of the 2015 International Conference on Industrial Engineering and Operations Management, Dubai, United Arab Emirates (UAE), March 3 – 5*.
37. Villanueva, M., Alejandro, A., & Ga-an, M. (2023). *Measuring the Service Quality, Customer Satisfaction, and Customer Loyalty of Selected Fast-Food Restaurants during the COVID-19 Pandemic*. *Open Journal of Business and Management*, 11(3).
38. Vyas, N. N. S., Makinde, O. G., Akinlabi, B. H., & Adefulu, A. D. (2023). *Quality management practices and productivity of selected food and beverages manufacturing firms in Lagos State, Nigeria*. *The Strategic Journal of Business & Change Management*, 10(2), 1266 – 1278.
39. Wanjiku, M. F., & Muli, S. (2022). *Influence of Supplier Relationship Management on the Performance of Food and Beverage Manufacturing Firms in Kenya: A Survey of Kiambu County*. *International Journal of Business and Social Research*, 12(3).
40. Worlu, G. O., & Somiari, G. A. (2017). *Operations Planning and Capacity Utilisation of Food and Beverage Firms in Rivers State*. *International Journal of Advanced Academic Research: Social & Management Sciences*, 3(8). DOI: 2488-9849
41. Wuanor, G. J., & Eke, R. E. (2022). *Relationship between Service Quality and Customer Satisfaction in Flour Mill Industry in Nigeria*. *International Journal of Business Systems and Economics*, 13(7). DOI: 2360-9923
42. Zahra, S. A., & Hayton, J. C. (2006). *The effect of international venturing on firm performance: The moderating influence of absorptive capability*. *Journal of Business Venturing*, 23(2), 195–220.
43. Zhou, L., Ayegba, J. O., Ayegba, E. O., Ayegba, P. M., & Jie, S. (2021). *Impact of dynamic capacities on the performance of food and beverage enterprises in Lagos, Nigeria*. *Journal of Innovation and Entrepreneurship*, 10.

**Appendix**

*Appendix 1: Hypothesis 1: Coefficients for: Being Customer-Centric and Profitability*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.213	.190		6.389	.000
	Being Customer Centric	.708	.048	.685	14.709	.000

a. Dependent Variable: Profitability

*Appendix 2: Hypothesis 2: Coefficients for: Continuous Improvement Process and Customers Repurchase Behavior*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.032	.047		.682	.496
	Continuous improvement Process	.984	.012	.983	83.550	.000

a. Dependent Variable: Customer Re-purchase Behaviour

*Appendix 3: Hypothesis 3: Coefficients for: Elimination of Waste and Quality of Products*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.219	.069		3.173	.002
	Elimination of Waste	.953	.018	.960	53.870	.000

a. Dependent Variable: Quality of Product

*Appendix 4: Hypothesis 4: Coefficients for: Leader Development and Reduction of Expenses*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.228	.080		2.856	.005
	Leader Development	.944	.020	.951	47.957	.000

a. Dependent Variable: Expense Reduction

*Appendix 5: Hypothesis 5: Coefficients for: Control Processes and Output*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.495	.112		4.410	.000
	Control Process	.875	.027	.901	32.509	.000

a. Dependent Variable: Output