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LEAN SIX SIGMA AND THE PERFORMANCE OF FOOD AND BEVERAGE MANUFACTURING FIRMS IN SOUTH-EAST, NIGERIA

Obodoagu, Kenneth Ogomegbunam
Department of Business Management, Godfrey Okoye University, Enugu

Keywords: *Lean, Manufacturing, performance, Sigma, Six*

Abstract: *The study evaluated Lean Six Sigma and the performance of Food and Beverage Manufacturing Firms in South-East, Nigeria. The specific objectives were to: evaluate the effect of the continuous improvement process on profitability; and ascertain the effect of leader development on the operational safety of food and beverage manufacturing firms in South-East, Nigeria. A survey design was adopted for the study. Instruments used for data collection were an interview guide and a questionnaire. The hypotheses were tested using the Z-test statistic tool with the aid of the Statistical Package for Social Sciences (SPSS) version 23. The study revealed that the Continuous improvement process had a significant positive effect on the profitability; Z = 7.098 < 10.089, P = 05; Leader development had a significant positive effect on the operational safety, Z = 7.098 < 10.089, P = 05. The study concluded that the continuous improvement process, leader development, customer focus, eliminating waste, and control processes had a significant positive effect on the profitability, operational safety of food and beverage manufacturing firms in South-East, Nigeria. The study recommended among others the food and beverage manufacturing firms should encourage Continuous improvement, as this will help individuals and organisations to constantly enhance their performance and achieve better results.*

1.1 INTRODUCTION

In every business, the relentless pursuit of process improvement is a hallmark of excellence, driven by the imperative to not only meet but surpass customer expectations. This is equally true for food and beverage manufacturing firms in South East, Nigeria, where the focus is squarely on enhancing product quality and customer satisfaction. The once-prevailing assumption that customers would remain loyal to brands regardless of their operational processes is rapidly becoming obsolete. Today, customers are discerning consumers, prioritising quality in their purchasing decisions. They are empowered to make informed choices based on their personal experiences and satisfaction levels. This shift underscores the pivotal role of Six Sigma in manufacturing, as highlighted by Aminu (2018). Lean, a multifaceted management system,

methodology, and philosophy, empowers employees to deliver superior product quality. Originating from car manufacturing, Lean's principles have transcended industries, finding applications in pharmaceuticals, electronics, and food and beverage manufacturing, where it significantly enhances process flow and reduces inefficiencies, as noted by Lot et al. (2018).

The applicability of Lean Six Sigma in the food and beverage manufacturing sector has evolved as a significant focus area in recent years. Increasing competitiveness within the industry and a drive to improve operational efficiencies have become central concerns for these organisations (McDermott, Antony, & Douglas, 2022). Lean Six Sigma offers numerous proven benefits, such as increasing capacity, reducing errors, and improving customer experience. Techniques such as data collection, Pareto analysis, cause and effect diagrams, and process maps are instrumental in understanding manufacturing processes and identifying the root causes of variation. Lean's emphasis on waste elimination and flow improvement, coupled with Six Sigma's focus on reducing process variability, can lead to significant enhancements in profitability and customer satisfaction (Gijo, Antony, Hernandez, & Scaria, 2013).

Continual pressures on manufacturing budgets, coupled with increasing demands and evidence of poor performance, have led food and beverage manufacturing firms to seek methods to improve quality, efficiency, and value in their operations (Sloan et al., 2014). Lean Six Sigma is often used in conjunction, combining Lean's ability to streamline processes and reduce waste with Six Sigma's rigorous approach to minimising variability. This combination has shown a marked impact on various aspects of manufacturing performance, including product quality, process efficiency, financial performance, and customer satisfaction (Seán et al., 2023). By harnessing the strengths of both methodologies, food and beverage manufacturers can achieve more consistent and predictable outcomes, ultimately enhancing their competitive edge in the market.

Lean Six Sigma's integration into food and beverage manufacturing is rooted in its statistical tools and techniques aimed at process improvement and variability reduction. Originating from Motorola's efforts to optimise manufacturing processes, Six Sigma uses data-driven methods to identify and eliminate defects. In manufacturing, Lean is typically employed to streamline production processes, while Six Sigma focuses on reducing unwanted variation in operations. Their combined use is particularly effective in addressing the complex challenges of the food and beverage industry, leading to improvements in production outcomes, process consistency, and overall product quality (Diego, 2024).

The food and beverage industry, with its intricate processes and high stakes, benefits immensely from Lean Six Sigma's systematic approach to problem-solving and quality enhancement. Even minor errors in production can lead to significant financial losses and potential safety hazards. By employing Lean Six Sigma, manufacturers can not only reduce these risks but also enhance operational efficiency and product consistency. This dual focus on

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waste reduction and variability minimisation enables firms to deliver higher quality products at lower costs, positioning them as leaders in a highly competitive market (Rathi, Khanduja, & Sharma, 2016). Given this backdrop, the present study aimed to examine the effect of Lean Six Sigma on the performance of food and beverage manufacturing firms in South-East Nigeria. By focusing on this specific region, the study seeks to explore how Lean Six Sigma methodologies can be effectively applied to enhance operational efficiencies, improve product quality, and increase overall customer satisfaction.

1.2 Statement of the Problem

As the emphasis on quality and waste reduction in manufacturing intensifies, Six Sigma methodology emerges as a pivotal concept in driving operational excellence. In the context of food and beverage manufacturing firms in South-East Nigeria, the challenge lies in continuously improving process efficiencies, enhancing product quality, and managing costs effectively. Six Sigma's systematic approach centred on process improvement and error reduction—has demonstrated significant benefits across various sectors. It offers a structured framework for addressing inefficiencies, optimizing processes, and achieving higher standards of operational performance.

In the manufacturing industry, Six Sigma has been instrumental in refining processes, reducing errors, and improving overall organizational effectiveness. By focusing on rigorous quality control and standardization, Six Sigma methodologies contribute to minimizing defects and enhancing product consistency. However, several issues persist that hinder optimal performance. These include inadequate continuous improvement processes, insufficient leader development, lack of customer focus, ineffective waste elimination strategies, challenges in revenue generation, and suboptimal control processes. Addressing these issues is crucial for increasing organizational performance and achieving desired outcomes.

The absence of a structured approach to process improvement not only limits profitability but also compromises operational safety, product quality, and revenue generation. Furthermore, the failure to integrate Lean Six Sigma principles into organizational practices has resulted in inefficiencies, increased production costs, and reduced customer satisfaction. Addressing these challenges is critical for food and beverage manufacturing firms in South-East Nigeria to enhance their competitiveness, meet regulatory standards, and achieve long-term sustainability. Therefore, this study sought to explore the extent to which Lean Six Sigma methodologies could be effectively applied to improve the performance of these firms, focusing on key areas such as profitability, operational safety, product quality, revenue generation, and service quality.

1.3 Objectives of the Study

The main objective of the study was to evaluate the effect of Lean six sigma on the performance of Food and beverage manufacturing firms in South-East, Nigeria. The specific objectives were to;

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i. Evaluate the effect of continuous improvement process on profitability of food and beverage manufacturing firms in South-East, Nigeria.

ii. Ascertain the effect of leader development on the operational safety of food and beverage manufacturing firms in South-East, Nigeria.

1.5 Statement of the Hypotheses

The following hypotheses guided the study

i. Continuous improvement process does not have significant effect on the profitability of food and beverage manufacturing firms in South-East, Nigeria.

ii. Leader development does not have significant effect on the operational safety of food and beverage manufacturing firms in South-East, Nigeria.

2.0 REVIEW OF RELATED LITERATURE

2.1 Conceptual Review

2.1.1 Lean Six Sigma

The origins of Lean Six Sigma can be traced back to the mid-20th century when two distinct yet complementary methodologies, Lean and Six Sigma, began to take shape. Lean principles emerged from the Toyota Production System (TPS) developed by Taiichi Ohno and Shigeo Shingo in the 1940s and 1950s. TPS focused on eliminating waste, improving process flow, and enhancing product quality through continuous improvement (Kaizen). Key milestones in the development of Lean include the introduction of Just-In-Time (JIT) inventory management and the 5S methodology for workplace organization (Sodhi, Singh, & Singh, 2020; Juliani & de Oliveira, 2020). In parallel, Six Sigma was developed at Motorola in the 1980s by engineer Bill Smith. Six Sigma aimed to reduce process variation and defects through a data-driven approach using statistical tools. The methodology gained prominence when Jack Welch adopted it at General Electric (GE) in the 1990s, leading to widespread implementation across various industries. Six Sigma's DMAIC (Define, Measure, Analyse, Improve, Control) framework became the cornerstone of process improvement initiatives (Parmar & Desai, 2020; Gupta, Modgil, & Gunasekaran, 2020).

The formal integration of Lean and Six Sigma methodologies began in the late 1990s and early 2000s as organizations recognized the complementary strengths of both approaches. Lean's focus on waste reduction and process flow improvement, combined with Six Sigma's emphasis on reducing process variation and defects, created a powerful synergy for driving operational excellence. The combined Lean Six Sigma methodology leverages the tools and techniques of both approaches to achieve significant improvements in process efficiency, quality, and customer satisfaction. For instance, the DMAIC framework from Six Sigma is enhanced by Lean tools such as Value Stream Mapping and Kaizen events to identify and eliminate waste. Conversely, Lean initiatives benefit from Six Sigma's rigorous statistical analysis and root cause identification to sustain long-term improvements (Singh & Rathi, 2019; Alexander, Antony & Cudney, 2022).

Continuous improvement process

Kaizen:

Kaizen, a Japanese term meaning "change for better," is a cornerstone of the Lean Six Sigma philosophy, emphasizing continuous,

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incremental improvement in all areas of an organization. The Kaizen philosophy involves everyone in the organization, from top management to frontline workers, in the process of identifying and implementing improvements. This inclusive approach fosters a culture of ongoing enhancement and encourages employees to take ownership of their work processes (Juliani & de Oliveira, 2020).

Kaizen practices typically involve small, manageable changes that can be implemented quickly and with minimal disruption. These changes are driven by the belief that small improvements, when continuously applied, will lead to significant overall advancements. Common practices under the Kaizen umbrella include regular team meetings to discuss improvement opportunities, the use of visual management tools to track progress, and the application of problem-solving techniques to address issues as they arise (Sodhi et al, 2020).

In the context of continuous improvement, Kaizen serves as a practical framework for sustaining and enhancing process efficiency and effectiveness. By systematically identifying and eliminating waste (muda), improving workflow, and fostering a proactive approach to problem-solving, Kaizen helps organizations maintain a competitive edge.

In the food and beverage manufacturing sector of South East Nigeria, Kaizen can be particularly beneficial. For example, it can be applied to optimize production lines, reduce downtime, and enhance product quality. Implementing Kaizen initiatives in these firms can lead to reduced operational costs, improved employee morale, and increased customer satisfaction by ensuring consistent delivery of high-quality products (Singh & Rathi, 2019).

Overall, Kaizen's focus on continuous, incremental improvements aligns perfectly with the principles of Lean Six Sigma, providing a robust foundation for achieving sustainable operational excellence.

Leader development

In the context of Lean Six Sigma (LSS), effective leadership is a critical determinant of the success of any project. Leaders play a pivotal role in driving the implementation of LSS methodologies, fostering a culture of continuous improvement, and ensuring that organizational goals align with LSS objectives. Their responsibilities extend to strategic planning, resource allocation, and facilitating communication across different levels of the organization (Gupta et al, 2020).

Leaders are also responsible for mentoring and guiding project teams. They must ensure that team members are adequately trained in LSS principles and practices, and they provide the necessary support to overcome obstacles and achieve project milestones. By setting clear expectations and creating an environment of accountability, leaders can motivate their teams to consistently deliver high-quality results (Singh & Rathi, 2019).

Skills and Competencies Required

The skills and competencies required for leaders in LSS projects are multifaceted and encompass both technical and interpersonal abilities. Key competencies include:

i. **Technical Expertise**: Leaders must have a deep understanding of LSS tools and

techniques, such as the DMAIC (Define, Measure, Analyse, Improve, Control) and DMADV (Define, Measure, Analyse, Design, Verify) frameworks. This technical knowledge enables them to guide their teams effectively and make informed decisions based on data analysis (Alexander et al., 2022).

ii. **Change Management**: Leaders must be adept at managing change within the organization. This involves communicating the benefits of LSS initiatives, addressing resistance, and ensuring that all stakeholders are engaged and supportive of the project goals. Effective change management helps to maintain momentum and ensures the sustainability of LSS improvements (Juliani & de Oliveira, 2020).

iii. **Project Management**: Strong project management skills are essential for planning, executing, and monitoring LSS projects. Leaders must be able to define project scopes, set timelines, allocate resources, and track progress against objectives. This ensures that projects stay on track and deliver the expected outcomes (Parmar & Desai, 2020).

iv. **Leadership and Team Building**: Successful LSS leaders are also effective leaders who can inspire and motivate their teams. They must be capable of building cohesive teams, fostering collaboration, and encouraging a culture of continuous improvement. By leveraging the diverse skills and perspectives of their team members, leaders can drive innovation and achieve superior results (Sodhi et al, 2020).

v. **Analytical and Problem-Solving Skills**: LSS projects require leaders to analyse complex data, identify root causes of problems, and develop effective solutions. Strong analytical and problem-solving skills enable leaders to tackle challenges head-on and implement improvements that enhance efficiency and quality (Parmar & Desai, 2020).

Performance

Performance, particularly in the context of Lean Six Sigma, is a multifaceted concept that involves not only the achievement of quantified objectives but also how those objectives are attained. In food and beverage manufacturing firms, performance is linked to both operational outcomes and the efficiency of processes used to achieve them. Lean Six Sigma methodologies emphasize reducing waste, optimizing processes, and improving overall efficiency, which directly impacts the performance of these firms. High performance arises from the integration of appropriate behaviours, effective knowledge utilization, and the consistent application of skills and competencies aimed at enhancing productivity and quality (Sodhi et al, 2020). This structured approach helps food and beverage firms convert their core values, such as a commitment to quality and operational excellence, into measurable results that drive business success. The continuous improvement culture fostered by Lean Six Sigma allows firms to adapt and thrive in competitive markets, especially in South-East Nigeria, where market dynamics are rapidly evolving (Singh & Rathi, 2019).

Profitability

Profitability is ability of a company to use its resources to generate revenues in excess of its expenses. Profitability determines whether a

business stays in business. Profitability is a business's ability to produce a return on an investment based on its resources in comparison with an alternative investment (Horton, Potters, & Munichiello, 2021). The success of every business depends on its ability to continually earn profits. The word profitability is composed of two words profit and ability. The term profit means to obtain a financial advantage or benefit while ability indicates the power of a business entity to earn profits. The ability of an organization also denotes its earning power or operating performance. It is a key factor in analysing an organizations financial status and a measurement of efficiency and ultimately its success or failure. Profitability looks at the relationship between the revenues and expenses to see how well a company is performing and the future potential growth a company might have. Profit equals a company's revenues minus expenses (Rose, 2019). Organizational profitability is a company's ability to generate net income from the activities carried out in an accounting period. Profitability is the ability of company to generate profits. Profit becomes basis of dividend distribution, whether cash dividends or stock dividends. Ojeani (2014) revealed the profit was obtained from difference between the incoming treasures (revenue and profit) and outlay (expenses and losses). Profit of company can be held (retained earnings) and can be divided (as cash dividends). Higher net profit increases the return on investment in form of dividend income to investors.

Operational safety

Operational safety is defined as the absence of unacceptable risks, injury or harm to the health of humans, whether direct or indirect, resulting from damage to equipment or the environment (Linde, 2024). A risk analysis allows for the determination of how operational safety will allow for a guarantee of adequate protection against any risk that may arise. These dangers are therefore treated appropriately during the design phase so that the final system is fault-free. Safety functions result from electrical, electronic or programmable electronic systems, which are usually complex and make it very difficult to determine breakdowns. The objective is therefore to design a system in such a way as to prevent as many breakdowns as possible and control them when they do occur. Operational safety therefore depends on the proper operations of a global system or equipment in response to system or equipment entries (CleaRSY, 2024). Operational safety focuses on safe and effective management of all our facilities (process plants, manufacturing sites, distribution centres, etc.) to prevent any harm to personnel, the environment and the communities in which we operate. Organizations ensure that all the employees and personnel working at the facilities are trained on the different hazards and appropriate controls (Linde, 2024). Operational safety is a core requirement for the successful operation of all of organizations. Operational safety requires a commitment to fully adopting a specific set of principles that ensures organization operate in a safe, reliable, and environmentally sound manner. Operational safety is the foundation upon which we provide the best in midstream

services to organization customers, while ensuring the safety of our employees, any contractors working for us, and the public. In order to effectively manage operations and meet commitments to customers, the company will provide the principles, leadership, and training to promote operational safety, as well as the appropriate equipment, facilities, policies, and practices to enable safe, secure and environmentally responsible operations (Crestwood, 2024).

2.2 Theoretical Framework

Resource-Based View (RBV) (Birger Wernerfelt in 1984)

The Resource-Based View (RBV) is a managerial framework used to determine the strategic resources a firm can exploit to achieve sustainable competitive advantage. The theory posits that the unique resources and capabilities of a firm are the primary determinants of its performance and competitive advantage. The theory was initially formulated by Birger Wernerfelt in 1984 (Wernerfelt, 1984) and later expanded by Jay Barney in 1991 (Barney & Arikan, 2005).

The RBV theory in support with objective one and five of the study. RBV emphasizes the importance of unique internal capabilities and resources, such as specialized knowledge and skills in Lean Six Sigma methodologies, which can drive continuous improvement processes. These internal resources can lead to increased efficiency, reduced costs, and higher profitability for food and beverage manufacturing firms (Madhani, 2021). By continuously improving processes, firms can enhance their operational efficiencies, leading to reduced cycle times and lower production costs. This, in turn, can improve the profitability of food and beverage manufacturing firms in South-East Nigeria. Lean Six Sigma's focus on reducing defects and variability also ensures that resources are utilized optimally, contributing further to financial performance improvements.

In addition, **c**ontrol processes are crucial resources for maintaining consistent quality. RBV underscores the importance of having robust control mechanisms in place, which are integral to Lean Six Sigma, to ensure high-quality service delivery and operational excellence. Implementing control charts, statistical process control (SPC), and other Lean Six Sigma tools helps maintain process stability and predictability. This ensures that products and services consistently meet quality standards, leading to enhanced customer satisfaction and loyalty. High-quality service delivery can differentiate firms from competitors, providing a sustainable competitive advantage (Beamish & Chakravarty, 2021).

2.3 Empirical Review

Nduka, Ogbuke, and Nwokeukwu (2024) conducted a study on the Effect of Responsiveness on the Sustainability of Food and Beverage Manufacturing Firms in Enugu State**.** The study examined the effect of responsiveness on the sustainability of food and beverage manufacturing firms in Enugu State. The specific objectives were to: examine the effect of promptly and effectively addressing tasks on the sales increase; and evaluate the effect of timely communication on the market

development of food and beverage manufacturing firms in Enugu state. The area of the study was Enugu State, Nigeria. The study used the descriptive survey design approach. Data was presented and analysed by mean score and standard deviation using the Sprint Likert Scale. The hypotheses were analysed using the Z-test statistic tool. The findings indicated promptly and effectively addressing tasks had a positive significant effect on the sales increase, Z (95, n = 214), 7.143 < 8.100, P <. 05 and Timely communication had a significant positive effect on the market development of food and beverage manufacturing firms in Enugu state, Z (95, n =214), 5.195 < 7.690, P. <. 05.

Kayode (2024) conducted a study on The Effect of Lean Manufacturing Practices on Supply Chain Performance in Food and Beverage Manufacturing Firms in Nigeria. The study examined the effect lean manufacturing practices and supply chain performance in food and beverage manufacturing firms in Ibadan, Oyo state. To achieve the objectives, three food and beverage manufacturing firms were randomly selected from the twelve food and beverage manufacturing firms quoted in Nigeria Stock Exchange (NSE). Simple random sampling technique was used to draw up the sample size of 155 managers from production, purchasing, quality control, warehouse/ store and physical distribution departments of food and beverage manufacturing firms. Structured questionnaire subjected to reliability test was used to collect the needed information from the respondents. The information elicited from respondents was analysed with descriptive statistics and multiple regression analysis. The study revealed that there is positive and significant relationship between lean manufacturing practices and supply chain performance. It revealed that pull system, six sigma, 5s, kaizen and supplier relationship are positively related to supply chain performance

Samuel and Barnabas (2021) conducted a study on the relationship between risk-taking and resilience of food and beverage manufacturing firms in south-south Nigeria. A cross-sectional survey design was adopted, while primary data was collected via the administration of a structured questionnaire. 321 copies of the questionnaire were distributed to the respondents and 297 copies were retrieved showing 93% retrieval rate. Data analysis was carried out with the aid of Statistical Package for Social Sciences (SPSS). The result of the analysis affirmed the alternate hypotheses which stated that risk-taking positively correlates with the measures of organizational resilience. Thus, concluded that risk-taking promotes resilience of the food and beverage manufacturing firms in south-south Nigeria.

Njoku (2021) conducted a study on the relationship between idealized influence, intellectual stimulation, and CI. Nigerian beverage industry managers (N = 160) who participated in the study completed the Multifactor Leadership Questionnaire Form 5X-Short, and the Plan, Do, Check, and Act (PDCA) cycle. The results of the multiple linear regression were statistically significant, F(2, 157) = 16.428, p < 0.001, R2 = 0.173. Idealized influence (ß = 0.242, p = 0.000) and intellectual

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stimulation (ß = 0.278, p = 0.000) were both significant predictors.

3. METHODOLOGY

A survey research design was adopted for the study. A structure questionnaire design with a point Likert scale was use to collect data for the study. The population of the study consists of employees of the selected food and beverage manufacturing firms in South-East Nigeria. The employees were made up of senior and junior employees from various sections of food and beverage manufacturing firms These made up the population of study of three thousand, five hundred and sixty-five (3,565) employees. The study sample size was three hundred and forth seven (347) respondents. The sample size, was determine using Freund and William's statistical formula. The data were analyzed using simple percentages, mean and standard deviation. (SPSS version 20 software descriptive statistics).

4. DATA PRESENTATION AND ANALYSES

4.1 Distribution and returned Questionnaire

The chapter presents and analyses the data collected for the study. The presentation and interpretation of data were based on the questionnaire administrated to the staff of the selected manufacturing firms in South-East, Nigeria.

Table 4.1 Distribution and Return of the Questionnaire

Firms	Distributed	No Returned	percent	No not Returned	Percent
1. Nigeria Breweries, Aba	50	49	14	2	1
2.M.O. Nnaji Bakeries, Aba	17	16	5	1	-
3.Tummy Tummy foods, Nnewi	37	35	10	2	1
4.Nigeria Bottling Co. Ltd., Onitsha	44	42	12	2	1
5.Jaypee Enterprises, Uburu	24	23	7	1	-
6 Abakaliki Rice Cluster	46	42	12	4	1
7.Nigerian Breweries Plc, Enugu	37	35	10	2	1

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8.Aqua Ralpha Investment, 9th Mile	42	36	10	6	2
9.Emmerald food, Owerri	38	37	11	1	-
10.Jacob Wine, Orlu	12	11	3	1	-
Total	**347**	**326**	**93.0**	**21**	**7.0**

Source: Field Survey, 2024

Table 4.1 shows that of the 347 distributed copies of the questionnaire, three hundred and twenty-six (326) were returned representing ninety-one (91) percent and used, while twenty-one (21) copies of the questionnaire representing seven (7) percent were not returned and were not used. This shows a high respondents' rate.

4.2 Bio Data

The bio-data shows the gender distribution, marital status of respondents, educational qualifications, and years of experience and age of the respondents under study.

Table 4.2.1 Gender Distribution

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	183	56.1	56.1	56.1
Female	143	43.9	43.9	100.0
Total	**326**	**100.0**	**100.0**	

Source: Field Survey, 2024

From table 4.2.1 it was observed that 183 respondents out of 326 representing 56.1 percent were males whereas 143 respondents representing 43.9 percent were females. This indicated that male were more than the females.

Table 4.2.2 marital status of Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Single	109	33.4	33.4	33.4
Married	191	58.6	58.6	92.0
Widowed	20	6.1	6.1	98.1
Divorced	6	1.9	1.9	100.0
Total	**326**	**100.0**	**100.0**	

Source: Field Survey, 2024

Table 4.2.2 reveals that 109 respondents out of 326 representing 33.4 percent were single, 191

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respondents representing 58.6 percent were married. 20 respondents representing 6.1 percent were widowed. 6 respondents representing 1.9 percent were divorced.

Table 4.2.3 Educational qualifications of the Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
WASC/GCE	88	27.0	27.0	27.0
OND/NCE	88	27.0	27.0	54.0
HND/B.Sc.	92	28.3	28.3	82.3
MBA/M.Sc.	37	11.3	11.3	93.6
PhD	21	6.4	6.4	100.0
Total	**326**	**100.0**	**100.0**	

Source: Field Survey, 2024

Table 4.2.3, reveals that 88 respondents out of 326 representing 27.0 percent were holders of WASC/GCE, 88 respondents representing 27.0 percent were holders of NCE/OND, 92 respondents representing 283 percent were holders of HND and BSC, 37 respondents representing 11.3 percent were holders of Masters degree and 21 respondents representing 6.4 percent were holders of PhD.

Table 4.2.4: Years of Experience

	Frequency	Percent	Valid Percent	Cumulative Percent
less than 1 - 2years	82	25.2	25.2	25.2
3-5years	208	63.8	63.8	89.0
6-10years	30	9.2	9.2	98.2
11 years and above	6	1.8	1.8	100.0
Total	**326**	**100.0**	**100.0**	

Source: Field Survey, 2024

Table 4.2.4, 82 respondents out of 326 representing 25.2 percent have less than 1 – 2 years experience, 208 respondents with 63.8 percent were within the years experience of 3 – 5 years, 30 respondents representing 9.2 percent were within the years' experience 6-10years, 6 respondents representing 1.8 percent were within the 11 years and above.

Table 4.2.5 Age of the respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
25-30years	53	16.3	16.3	16.3

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31-35years	77	23.6	23.6	39.9
36-40years	89	27.3	27.3	67.2
45- 50years	19	5.8	5.8	73.0
51years and above	88	27.0	27.0	100.0
Total	**326**	**100.0**	**100.0**	

Source: Field Survey, 2024

Table 4.2.5, 53 respondents out of 326 representing 16.2 percent were within the age of 25 - 30years, 77 respondents with 23.6 percent were within the age bracket of 31-35, 89 respondents representing 27.3 percent were within the age bracket of 36 – 40years, 19 respondents representing 5.8 percent were within the age bracket of 45-50 years while 88 respondents representing 27.0 percent were within the age bracket of 51 years and above. This implies that greater proportion of the respondents fall within the ages of 36 - 40 years.

4.3 Data Presentation and Analyses

4.3.1 The effect of continuous improvement process on profitability of food and beverage manufacturing firms in South-East, Nigeria.

Table 4.3.1.1: Responses on the effect of continuous improvement process on profitability of food and beverage manufacturing firms in South-East, Nigeria.

		5 SA	4 A	3 N	2 DA	1 SD	∑FX	- X	SD	Decision
1	There is improvement to service which promotes best outcomes	900 180 55.2	140 35 10.7	129 43 13.2	84 42 12.9	26 26 8.0	1,279 326 100.0	3.92	1.385	Agree
2	Continuous improvement enables the organisations to make an ongoing commitment to change and apply better success	915 183 56.1	112 28 8.6	117 39 12.0	86 43 13.2	33 33 10.1	1263 326 100.0	3.87	1.453	Agree
3	The continuous, interactive improvement is linked with innovation which	640 128 39.3	112 28 8.6	279 93 28.5	66 33 10.1	44 44 13.5	1141 326 100.0	3.5	1.433	Agree

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	helps customers in getting better services.									
4	Small incremental changes add up to significant results that prevent damaged goods.	725 145 44.5	324 81 24.8	93 31 9.5	26 13 4.0	56 56 17.2	1224 326 100.0	3.75	1.481	Agree
5	Continuously reviewing results and adopting new measures ameliorate spoilt goods	975 195 59.8	188 47 14.4	60 20 6.1	76 38 11.7	26 26 8.0	1325 326 100.0	4.06	1.358	Agree
	Total Grand mean and standard deviation							**19.1**	**7.11**	

Source: Field Survey, 2024

Table 4.3.1.1., 215 respondents out of 326 representing 65.9 percent agreed that there is improvement to service which promotes best outcomes with mean score 3.92 and standard deviation of 1.385. 211 respondents representing 64.7 percent agreed that continuous improvement enables the organisations to make an ongoing commitment to change and apply better success with mean score of 3.87 and standard deviation of 1.453. 156 respondents representing 47.9 percent agreed that the continuous, interactive improvement is linked with innovation which helps customers in getting better services with mean score of 3.5 and standard deviation of 1.433. 226 respondents representing 69.3 percent agreed with that Small incremental change add up to significant results that prevent damaged goods Mean score of 3.75 and 1.481. 242 respondents representing 74.2 percent agreed that continuously reviewing results and adopting new measures ameliorate spoilt goods with a mean score of 4.06 and standard deviation 1.358.

4.3.2 The effect of leader development on the operational safety of food and beverage manufacturing firms in South-East, Nigeria.

Table 4.3.2.1: Responses on the effect of leader development on the operational safety of food and beverage manufacturing firms in South-East, Nigeria.

	5 SA	**4 A**	**3 N**	**2 DA**	**1 SD**	**∑FX**	**-X**	**SD**	**Decision**

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1	Leader's training helps improve employee safety.	580 116 35.6	 360 92 28.2	45 15 4.6	13 8 69 21.2	34 34 10.4	1157 326 100.0	3.55	1.418	Agree
2	The level of leader's education promotes treating staff and customers in safe environment.	715 143 43.9	440 110 33.7	48 16 4.9	8 4 1.2	53 53 16.3	1264 326 100.0	3.88	1.411	Agree
3	Investing in development of leader's enhances growth and promotes staff skills.	945 189 58.0	360 90 27.6	45 15 4.6	54 18 5.5	14 14 4.3	1418 326 100.0	4.35	1.072	Agree
4	Making learning programs and experiences flexible and relevant boost leaders and improve employee safety.	820 164 50.3	476 119 36.5	39 13 4.0	36 18 5.5	12 12 3.7	1383 326 100.0	4.24	1.020	Agree
5	Enhancing the leadership abilities of any member of an organization reduces customer's risk.	450 90 27.6	588 147 45.1	39 13 4.0	10 8 54 16.6	22 22 6.7	802 326 100.0	2.46	1.226	Agree
	Total Grand mean and standard deviation							**18.48**	**6.1447**	

Source: Field Survey, 2024

Table 4.3.2.1., 208 respondents out of 326 representing 63.8 percent agreed that Leaders training helps improve employee safety with mean score 3.55 and standard deviation of 1.418. 253 respondents representing 77.6 percent agreed that level of leader's education promotes treating staff and customers in safe environment with mean score of 3.88 and standard deviation of 1.411. 279 respondents representing 85.6 percent agreed with that investing in development of leader's enhances growth and promotes staff skills mean score of 4.35 and standard deviation of 1.072. 185 respondents representing 86.8 percent agreed that Making learning programs and experiences flexible and

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relevant boost leaders and improve employee safety with mean score of 4.24 and standard deviation of 1.020. 237 respondents representing 72.7 percent agreed that enhancing the leadership abilities of any member of an organization reduces customer's risk with a mean score of 2.46 and standard deviation 1.226.

4.4 Test of Hypotheses

4.4.1 Hypothesis One: Continuous improvement process has significant effect on the profitability of food and beverage manufacturing firms in South-East, Nigeria.

One-Sample Kolmogorov-Smirnov Test

		There is improvement to service which promotes better outcomes.	Continuous improvement enables the organisations to make an ongoing commitment to change and apply better success.	The continuous, interactive improvement is linked with innovation which helps customers in getting better services.	Small incremental changes add up to significant results that prevent damaged goods	Continuously reviewing results and adopting new measures ameliorate spoilt goods
N		326	326	326	326	326
Uniform Parameters[a,b]	Minimum	1	1	1	1	1
	Maximum	5	5	5	5	5
Most Extreme Differences	Absolute	.552	.561	.393	.445	.598
	Positive	.080	.101	.135	.172	.080
	Negative	-.552	-.561	-.393	-.445	-.598
Kolmogorov-Smirnov Z		9.969	10.135	7.089	8.031	10.800

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Asymp. Sig. (2-tailed)	**.000**	**.000**	**.000**	**.000**	**.000**

a. Test distribution is Uniform.

b. Calculated from data.

Decision Rule

If the calculated Z-value is greater than the critical Z-value (i.e. Z_{cal} > Zcritical), reject the null hypothesis and accept the alternative hypothesis accordingly. Result with Kolmogorov-Smirnon Z – value of 7.098 < 10.089 and on Asymp. Significance of 0.000, the responses from the respondents as display in the table is normally distributed. This affirms the assertion of the most of the respondents that continuous improvement process had significant positive effect on the profitability of food and beverage manufacturing firms in South-East, Nigeria

Decision

Furthermore, comparing the calculated Z- value of 7.098 < 10.089 against the critical Z- value of .000 (2-tailed test at 97percent level of confidence) the null hypothesis was rejected. Thus, the alternative hypothesis was accepted which states that continuous improvement process had significant positive effect on the profitability of food and beverage manufacturing firms in South-East, Nigeria.

4.4.2 Hypothesis Two: Leader development has significant effect on the operational safety of food and beverage manufacturing firms in South-East, Nigeria.

One-Sample Kolmogorov-Smirnov Test

		Leader's training helps improve employee safety	**The level of leader's education promotes treating staff and customers in safe environment**	**Investing in development of leader's enhances growth and promotes staff skills**	**Making learning programs and experiences flexible and relevant boost leaders and improve employee safety.**	**Enhancing the leadership abilities of any member of an organization reduces customer's risk.**
N		**326**	**326**	**326**	**326**	**326**
Uniform Parameters[a,b]	**Minimum**	**1**	**1**	**1**	**1**	**1**
	Maximum	**5**	**5**	**5**	**5**	**5**

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Most Extreme Differences	**Absolute**	**.388**	**.526**	**.606**	**.618**	**.477**
	Positive	**.104**	**.163**	**.043**	**.037**	**.067**
	Negative	**-.388**	**-.526**	**-.606**	**-.618**	**-.477**
Kolmogorov-Smirnov Z		**7.006**	**9.499**	**10.939**	**11.160**	**8.612**
Asymp. Sig. (2-tailed)		**.000**	**.000**	**.000**	**.000**	**.000**

a. Test distribution is Uniform.
b. Calculated from data.

Decision Rule

If the calculated Z-value is greater than the critical Z-value (i.e. $Z_{cal} > Z_{critical}$), reject the null hypothesis and accept the alternative hypothesis accordingly. Result with Kolmogorov-Smirnon Z – value of 7.006 < 11.160 and on Asymp. Significance of 0.000, the responses from the respondents as display in the table is normally distributed. This affirms the assertion of the most of the respondents that leader development had significant positive effect on the operational safety of food and beverage manufacturing firms in South-East, Nigeria.

Decision

Furthermore, comparing the calculated Z- value of 7.006 < 11.160 against the critical Z- value of .000 (2-tailed test at 97percent level of confidence) the null hypothesis was rejected. Thus, the alternative hypothesis was accepted which states that leader development had significant positive effect on the operational safety of food and beverage manufacturing firms in South-East, Nigeria.

5. CONCLUSION

The study concluded that continuous improvement process, leader development, customer focus, eliminating waste and control processes had significant positive effect on the profitability, operational safety, product quality, revenue generation and quality service of food and beverage manufacturing firms in South-East, Nigeria. Lean Six Sigma is a powerful methodology for enhancing performance in food and beverage manufacturing firms. It has proven to be highly effective in improving the performance of food and beverage manufacturing firms by addressing inefficiencies and reducing variability. The integration of Lean principles, which focus on eliminating waste and streamlining processes, with Six Sigma's emphasis on reducing defects and improving quality, creates a comprehensive framework for operational excellence.

RECOMMENDATIONS

Based on the findings, the following recommendations were proffered:

I. The food and beverage manufacturing firms should encourage Continuous

improvement as this will help individual and organizations to constantly enhance their performance and achieve better results. By continually looking for ways to improve, we can identify areas of weakness, streamline our processes, and enhance our skills and knowledge. Continuous Improvement increases the effectiveness of response and recovery efforts by ensuring emergency managers are able to routinely identify strengths, areas for improvement, potential best practices, and mission critical issues.

II. There is need for leadership development for future success and impacting on leader's ability to motivate teams, unlock their potential, and navigate change. This will increase employee morale and retention, improve productivity, promote better decision-making, build better teams, and train future leaders in your company who have a management style that is conducive to a positive working atmosphere.