

THE RELATIONSHIP BETWEEN RAW MATERIALS INSPECTION AND PRODUCTION QUALITY OF MANUFACTURING FIRMS IN RIVERS STATE

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ABSTRACT

This study examined the relationship between raw materials inspection and production quality of manufacturing firms in Rivers State. Correlational survey research design was adopted for this study as this study seek to determine the relationship between the two variables. The population of this study is thirty two (32) manufacturing companies in Rivers State which are registered with the Rivers state branch of Manufacturers Association of Nigeria (MAN). The study adopted the census techniques. With regard to the respondents of the study given the strategic nature of the study, three key managers (production manager, quality assurance unit manager and logistics manager) were chosen as respondents from each using simple random sampling, of the thirty two firms constitute the study subject. This gave us a total of ninety two (92) for the study. Structured questionnaire instrument titled "raw material inspection and production quality of manufacturing firms questionnaire" was developed on five point likert scale. The result of the Cronbach's Alpha reliability test indicates .708 which is above .70 which implies that the items are reliable. Pearson product moment correlation was used to test the hypotheses using SPSS (statistical package social sciences). The study revealed that there is a significant relationship between visual inspection and conformance quality of manufacturing firms in Rivers State. There is a significant relationship between visual inspection and performance quality of manufacturing firms in Rivers state. There is a significant relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers state. There is a significant relationship between dimensional inspection and performance quality of manufacturing firms in Rivers state. The study concluded that there is positive relationship between raw materials inspection and production quality of manufacturing firms in Rivers State. The study recommended that manufacturing firms should implement a comprehensive raw materials inspection process that includes both visual and dimensional inspections to ensure the quality and consistency of incoming materials.

INTRODUCTION

Background to the Study

Raw materials inspection, including visual inspection and dimensional inspection, is a critical aspect of quality control in manufacturing processes. Raw materials are the basic components used in the production of goods, and ensuring their quality is essential to producing high-quality final products. Visual inspection involves visually examining raw materials for any defects or irregularities that may affect their performance or suitability for use in manufacturing. Dimensional inspection, on the other hand, involves measuring the physical dimensions of raw materials to ensure they meet the required specifications (Akubugwo, et al.,2014).

Adeyeye and Ogunmakinwa (2018) the study on raw materials inspection is important because it helps manufacturers identify any issues with the raw materials early in the production process, allowing them to take corrective actions before these materials are used in manufacturing. By conducting thorough inspections of raw materials, manufacturers can prevent defects in finished products, reduce waste, and improve overall product quality. In addition to ensuring product quality, raw materials inspection also plays a crucial role in maintaining safety standards and compliance with regulations. Defective raw materials can pose safety risks to workers and consumers, as well as lead to legal liabilities for manufacturers. Therefore, implementing robust inspection procedures for raw materials is essential for ensuring both product quality and safety (National Bureau of Statistics, 2018).

Oyeniya and Olanrewaju (2014) Production quality, also known as manufacturing quality, refers to the level of excellence in the products or services produced by a company. It encompasses two main dimensions: conformance quality and performance quality. Conformance quality refers to the degree to

which a product meets its design specifications and standards. It focuses on ensuring that products are produced consistently and meet the required criteria. Conformance quality is crucial for maintaining customer satisfaction and loyalty, as it ensures that products meet the promised specifications and perform as expected. Performance quality, on the other hand, refers to how well a product performs its intended function or purpose. It goes beyond meeting specifications to assess how effectively a product meets customer needs and expectations. Performance quality is essential for building a strong reputation in the market and gaining a competitive edge over rivals (Egbuonu & Okoroafor, 2013).

The study on raw materials inspection and production quality of manufacturing firms in Rivers State focuses on examining the processes involved in inspecting raw materials and ensuring high production quality within manufacturing companies located in Rivers State, Nigeria. This research is crucial as it contributes to understanding the challenges faced by manufacturing firms in maintaining high-quality standards in their production processes. By investigating the methods used for raw materials inspection and quality control, this study aims to provide insights into improving the overall efficiency and effectiveness of manufacturing operations in Rivers State (Egbuonu & Okoroafor, 2013).

Manufacturers Association of Nigeria (2017) Manufacturing firms rely heavily on raw materials to produce goods, making the inspection of these materials a critical step in ensuring the quality of the final products. By implementing robust inspection procedures, companies can identify any defects or inconsistencies in raw materials early on, thus preventing potential issues during the production process. Additionally, maintaining high production quality is essential for meeting customer expectations, complying with industry regulations, and sustaining a competitive edge in the market. In Rivers State, where manufacturing plays a significant role in the economy, understanding how firms manage raw materials inspection and production quality is vital for enhancing overall productivity and profitability. Factors such as supply chain management, technological advancements, regulatory compliance, and workforce training all influence the effectiveness of raw materials inspection and quality control practices within manufacturing firms.

By conducting a comprehensive study on raw materials inspection and production quality in manufacturing firms in Rivers State, researchers can identify best practices, challenges, and opportunities for improvement in this critical aspect of industrial operations. The findings from this research can inform policymakers, industry stakeholders, and company managers on strategies to enhance raw materials inspection processes and ensure high production quality standards are consistently met. It is in the light of the above that this study is carried out to determine the relationship between raw materials inspection and production quality of manufacturing firms in Rivers State.

Statement of the Problem

One of the major problems affecting raw materials inspection and production quality in manufacturing firms in Rivers State is the lack of adequate testing and inspection equipment. Many small and medium-sized enterprises (SMEs) in the region lack access to modern testing equipment, which can result in substandard products and compromise consumer safety. For instance, a study on the challenges faced by SMEs in Rivers State found that 60% of the surveyed firms reported inadequate testing equipment as a significant obstacle to maintaining product quality (Egbuonu & Okoroafor, 2013). To address this issue, both the government and private sector should invest in providing affordable testing and inspection facilities to SMEs.

Inadequate training and skills among the workforce is another challenge affecting raw materials inspection and production quality in manufacturing firms. Many employees lack the necessary knowledge to operate modern testing equipment or interpret test results accurately. This can lead to errors during the inspection process, resulting in substandard products reaching consumers. A report on skill gaps in Nigeria's manufacturing sector revealed that 56% of employers rated workforce skills as fair or poor, indicating a significant need for training investments (Manufacturers Association of Nigeria, 2017). Providing regular training programs for employees can help improve their skills and knowledge, ultimately enhancing product quality.

Poor storage conditions for raw materials can negatively affect product quality. Exposure to extreme temperatures, humidity, or contaminants can degrade raw materials, leading to inconsistent product quality. According to a study on the challenges facing the Nigerian food processing industry, poor storage conditions were identified as a significant factor affecting product quality (Akubugwo et al., 2014).

Investing in proper storage facilities such as temperature-controlled warehouses can help mitigate this issue. The absence of stringent quality standards and enforcement mechanisms is also a challenge affecting raw materials inspection and production quality in manufacturing firms in Rivers State. Without clear guidelines on acceptable product quality levels, some manufacturers may cut corners or use substandard raw materials to reduce costs. Additionally, weak enforcement mechanisms allow manufacturers to produce low-quality products without fear of consequences. Developing robust quality standards and enforcing them through regular inspections can help ensure that manufacturers maintain high-quality production processes.

Corruption and unethical practices are prevalent issues in Nigeria's manufacturing sector, which can significantly affect raw materials inspection and production quality. Bribery, falsification of test results, or other unethical practices can lead to substandard products being released into the market (Adeyeye & Ogunmakinwa, 2018). Addressing corruption requires a multi-faceted approach involving stricter regulations, stronger enforcement mechanisms, and cultural changes within organizations. Whistleblower protection programs can also encourage employees to report unethical practices without fear of retaliation.

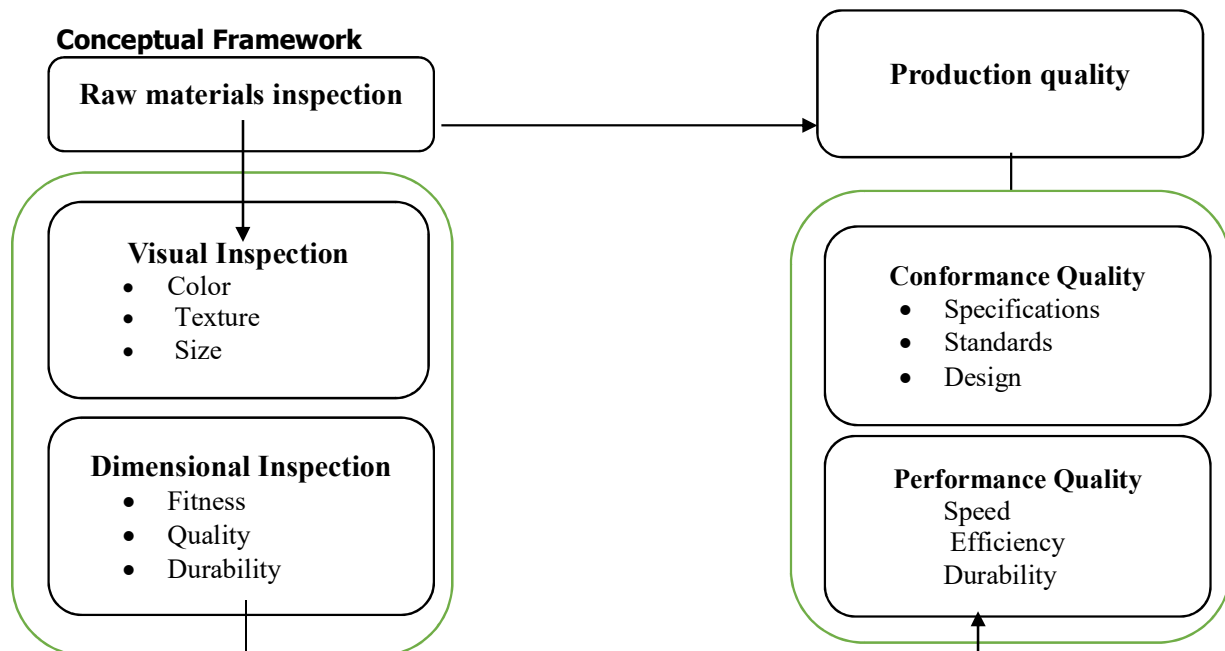


Figure 1: Conceptual Framework on Raw materials inspection and production quality of manufacturing firms in Rivers state

Source: Smith (2020) and Garvin, (2020).

Aim & Objectives

The aim of this study is to determine the relationship between raw materials inspection and production quality of manufacturing firms in Rivers state. The study specific objectives are to:

- 1) determine the relationship between visual inspection and conformance quality of manufacturing firms in Rivers state.
- 2) investigate the relationship between visual inspection and performance quality of manufacturing firms in Rivers state.
- 3) determine the relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers state.
- 4) examine the relationship between dimensional inspection and performance quality of manufacturing firms in Rivers state.

Research Questions

The following research questions were raised to guide the study.

- 1) What is the relationship between visual inspection and conformance quality of manufacturing firms in Rivers state?
- 2) What is the relationship between visual inspection and performance quality of manufacturing firms in Rivers state?
- 3) What is the relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers state?
- 4) What is the relationship between dimensional inspection and performance quality of manufacturing firms in Rivers state?

Research Hypotheses

The following null hypotheses were formulated and tested at a significant level of 0.01.

HO₁: There is no significant relationship between visual inspection and conformance quality of manufacturing firms in Rivers State.

HO₂: There is no significant relationship between visual inspection and performance quality of manufacturing firms in Rivers state.

HO₃: There is no significant relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers state.

HO₄: There is no significant relationship between dimensional inspection and performance quality of manufacturing firms in Rivers state.

Significance of the study

The study on raw materials inspection and production quality of manufacturing firms in Rivers State holds significant importance in the realm of industrial operations and quality management. Raw materials inspection is a crucial aspect of manufacturing processes as it directly impacts the quality, efficiency, and cost-effectiveness of production. By examining the inspection procedures and practices related to raw materials in manufacturing firms in Rivers State, researchers can identify potential areas for improvement, enhance quality control measures, optimize production processes, and ultimately contribute to the overall competitiveness and sustainability of these firms.

Moreover, focusing on production quality within manufacturing firms in Rivers State allows for a comprehensive evaluation of the factors influencing product quality, such as raw material selection, processing techniques, equipment maintenance, workforce skills, and adherence to industry standards. Understanding the intricacies of production quality not only helps in ensuring customer satisfaction but also aids in minimizing defects, reducing waste, increasing productivity, and fostering continuous improvement within manufacturing operations.

By shedding light on the challenges and opportunities associated with raw materials inspection and production quality in Rivers State's manufacturing sector, this study can provide valuable insights for policymakers, industry practitioners, researchers, and other stakeholders seeking to enhance the competitiveness and sustainability of the region's industrial base. The study on raw materials inspection and production quality of manufacturing firms in Rivers State has several categories of persons that will benefit from the study. These categories include:

1. **Manufacturing Firms:** The primary beneficiaries of this study are manufacturing firms in Rivers State. The findings of this study will provide insights into the importance of raw materials inspection and production quality in their operations. By implementing the recommendations from this study, manufacturing firms can improve their production processes, reduce wastage, and increase their overall productivity.
2. **Government Agencies:** Government agencies responsible for regulating and promoting the manufacturing sector in Rivers State will also benefit from this study. The findings will highlight areas where government intervention may be necessary to improve the quality of raw materials and production processes in the state's manufacturing sector. This information can be used to inform policy-making and regulatory decisions.
3. **Researchers:** Researchers in the field of manufacturing and quality control will find this study useful as it provides empirical evidence on the relationship between raw materials inspection and production quality in manufacturing firms. This study can also serve as a basis for further research in this area.

4. **Students:** Students studying industrial engineering, manufacturing, or quality control can use this study as a reference material for their coursework or research projects. The study provides valuable insights into real-world applications of raw materials inspection and production quality concepts.
5. **General Public:** Ultimately, the general public will benefit from improved production quality in the manufacturing sector as it leads to better products and services. This can contribute to economic growth and development in Rivers State, leading to a higher standard of living for its residents.

LITERATURE REVIEW

This section reviews conceptual, theoretical, empirical review and gap in literature related to the study under investigation.

Conceptual Review

Raw materials inspection

Raw materials inspection is a crucial process in manufacturing and production industries to ensure the quality and integrity of the materials used in the production process. This process involves examining and testing raw materials before they are used in manufacturing to identify any defects, inconsistencies, or contaminants that could affect the quality of the final product. Raw materials inspection helps companies maintain quality standards, reduce waste, and prevent costly recalls or rework (Akubugwo, et al.,2014).

Adeyeye and Ogunmakinwa (2018) during raw materials inspection, trained inspectors typically perform visual inspections, measurements, and tests on samples of raw materials to assess their quality and suitability for use in production. Inspectors may use a variety of tools and techniques such as spectroscopy, microscopy, chemical analysis, and mechanical testing to evaluate the physical, chemical, and mechanical properties of raw materials. Any raw materials that do not meet the specified quality standards are either rejected or subjected to further processing or treatment to bring them into compliance. Raw materials inspection is essential for ensuring product quality, consistency, and safety. By identifying and addressing issues with raw materials early in the production process, companies can avoid defects in finished products, reduce waste, improve efficiency, and protect their reputation with customers. Effective raw materials inspection processes are critical for industries such as pharmaceuticals, food and beverage, automotive, aerospace, electronics, and construction where product quality and safety are paramount.

Egbuonu and Okoroafor (2013) Raw materials inspection plays a vital role in maintaining high-quality standards in manufacturing industries by ensuring that only suitable raw materials are used in production processes. By implementing rigorous inspection procedures and quality control measures for raw materials, companies can enhance product quality, reduce costs associated with defects or recalls, and ultimately improve customer satisfaction. Raw materials inspection is a crucial process in various industries, including manufacturing, construction, and food production. This quality control measure involves examining the raw materials used in production to ensure they meet the required standards and specifications. There are several benefits associated with raw materials inspection: Quality Assurance: Raw materials inspection helps to ensure that only high-quality materials are used in the production process. By identifying any defects or inconsistencies early on, manufacturers can prevent substandard products from reaching the market.

Manufacturers Association of Nigeria (2017) Inspecting raw materials before they are used in production can help companies avoid costly rework or product recalls. By catching issues early, manufacturers can address them before they escalate into larger problems that could impact the entire production process. Raw materials inspection is essential for ensuring compliance with industry regulations and standards. By verifying that raw materials meet all necessary requirements, companies can avoid potential legal issues and maintain their reputation within the industry. Inspecting raw materials helps to identify potential risks in the supply chain, such as contamination or fraud. By conducting thorough inspections, companies can reduce the likelihood of these risks impacting their operations. By streamlining the raw materials inspection process, companies can improve overall efficiency in their production operations. Identifying and addressing issues early on can help to minimize disruptions and keep production running

smoothly. Overall, raw materials inspection plays a critical role in ensuring product quality, reducing costs, maintaining compliance, mitigating risks, and improving operational efficiency in various industries.

Dimensions of Raw Material Inspections

Visual Inspection

Anderson and Wilson (2015) Raw material inspection, particularly in terms of visual inspection, is a crucial process in various industries to ensure the quality and integrity of materials used in production. Visual inspection involves examining raw materials with the naked eye or using magnifying tools to detect any visible defects, irregularities, or inconsistencies that may affect the final product's quality. This method helps identify issues such as physical damage, contamination, color discrepancies, and other visual imperfections that could compromise the safety and performance of the end product (Montgomery, 2012).

Pyzdek and Paul (2014) During visual inspection of raw materials, inspectors typically look for signs of damage, such as cracks, dents, scratches, or discoloration. They also check for foreign particles, impurities, or any deviations from the specified standards or requirements. In some cases, specialized equipment like microscopes or cameras may be used to enhance the inspection process and capture detailed images for further analysis. Visual inspection is often one of the initial steps in the quality control process for raw materials. By identifying and addressing visual defects early on, manufacturers can prevent costly rework or production delays downstream. Additionally, visual inspection helps maintain consistency and uniformity in the manufacturing process by ensuring that only high-quality materials are used.

Juran and Blanton (2016) visual inspection plays a vital role in raw material inspection by providing a quick and effective way to assess the quality and suitability of materials for production processes. By implementing rigorous visual inspection protocols, companies can uphold quality standards, minimize risks, and deliver products that meet customer expectations.

Dimensional Inspection

Besterfield (2011) Raw material inspection, specifically in terms of dimensional inspection, is a crucial process in manufacturing industries to ensure the quality and accuracy of the materials used in production. Dimensional inspection involves verifying the physical dimensions of raw materials against specified tolerances and requirements to guarantee that they meet the necessary standards for the intended application. This process typically involves measuring various aspects such as length, width, height, diameter, thickness, and other critical dimensions using specialized tools and equipment like calipers, micrometers, coordinate measuring machines (CMM), optical comparators, and laser scanners. Hoyle (2018) during raw material inspection for dimensional accuracy, each piece of material is carefully examined to ensure it conforms to the specified dimensions outlined in engineering drawings or product specifications. Any deviations from the required measurements can lead to defects in the final product or cause assembly issues during manufacturing processes. By conducting thorough dimensional inspections on raw materials before they are processed further, manufacturers can identify any non-conformities early on and take corrective actions to prevent quality issues down the line.

In addition to dimensional inspection, raw material inspection may also involve other types of testing such as visual inspection, material composition analysis, mechanical property testing, surface finish evaluation, and more depending on the specific requirements of the industry and application. Overall, dimensional inspection plays a vital role in maintaining quality control and ensuring that only materials meeting precise dimensional specifications are used in production processes (Besterfield, 2011).

Production Quality

Production quality in manufacturing firms refers to the level of excellence and consistency in the products manufactured by a company. It encompasses various aspects such as adherence to specifications, reliability, durability, performance, and overall customer satisfaction. Maintaining high production quality is crucial for manufacturing firms as it directly impacts their reputation, customer loyalty, and competitiveness in the market. Achieving high production quality involves implementing rigorous quality

control measures throughout the manufacturing process (Garcia & Martinez, 2014). This includes using advanced technologies and equipment, ensuring strict adherence to quality standards and regulations, conducting thorough inspections and testing procedures, and continuously monitoring and improving production processes. By focusing on production quality, manufacturing firms can reduce defects, minimize waste, enhance efficiency, and ultimately deliver superior products to their customers (Besterfield, 2011).

Hoyle (2018) investing in research and development (R&D) activities can also contribute to improving production quality in manufacturing firms. By innovating new technologies, materials, and processes, companies can enhance product performance, reliability, and durability. Continuous R&D efforts enable firms to stay ahead of competitors, meet evolving customer demands, and adapt to changing market trends. In conclusion, production quality plays a critical role in the success of manufacturing firms. By prioritizing quality control measures, investing in R&D initiatives, and fostering a culture of excellence within the organization, companies can ensure that they consistently deliver high-quality products that meet or exceed customer expectations.

Juran and Blanton (2016) Production quality in manufacturing firms refers to the level of excellence and consistency in the products or services they deliver. It is a critical aspect of operations that directly impacts customer satisfaction, brand reputation, and overall business success. Achieving high production quality involves various processes, systems, and standards that ensure products meet or exceed customer expectations. Here, we will discuss extensively the importance of production quality in manufacturing firms.

Manufacturers Association of Nigeria (2017) Quality control is a fundamental aspect of ensuring production quality in manufacturing firms. It involves monitoring and inspecting products at various stages of the production process to identify defects or deviations from specifications. By implementing robust quality control measures, firms can detect and rectify issues early on, preventing defective products from reaching customers. Continuous improvement is another key factor in enhancing production quality. Manufacturing firms should strive to continuously optimize their processes, technologies, and workforce skills to achieve higher levels of quality and efficiency. By fostering a culture of continuous improvement, firms can adapt to changing market demands and stay ahead of competitors. Oyeniyi and Olanrewaju (2014) Standardization plays a crucial role in maintaining consistent production quality across different product lines or manufacturing facilities. By establishing standardized processes, specifications, and performance metrics, firms can ensure that products meet predefined quality standards regardless of variations in production conditions. Employee training is essential for ensuring that workforce members possess the necessary skills and knowledge to maintain high production quality standards. Training programs should focus on enhancing technical competencies, problem-solving abilities, and adherence to quality protocols to minimize errors and defects in the production process. Customer feedback is a valuable source of information for evaluating production quality from an external perspective. Manufacturing firms should actively solicit feedback from customers through surveys, reviews, or direct communication channels to identify areas for improvement and address any concerns related to product quality. In conclusion, production quality is a critical determinant of success for manufacturing firms as it directly influences customer satisfaction, brand reputation, and overall competitiveness in the market. By prioritizing quality control, continuous improvement, standardization, employee training, and customer feedback, firms can enhance their production quality levels and achieve sustainable growth in the long run (Manufacturers Association of Nigeria 2017).

Measures of Production Quality

Conformance Quality

Conformance quality, also known as conformity quality, refers to the degree to which a product or service meets specified standards and requirements. In the context of production quality, conformance quality is a critical aspect that ensures consistency and reliability in the manufacturing process. It involves adhering to predefined specifications, standards, and regulations to produce goods that meet customer expectations and comply with industry norms. Achieving conformance quality in production involves several key elements: Specification Compliance: Manufacturers must ensure that products are produced according to the specified design, dimensions, materials, and performance criteria. Deviations from these

specifications can result in defects and non-conformities. Quality Control: Implementing robust quality control measures is essential to monitor and evaluate production processes at various stages. This includes inspections, testing, and analysis to identify any deviations from the desired standards (Pyzdek, 2014).

Oakland, (2003) maintaining consistency in manufacturing processes is crucial for achieving conformance quality. Standardizing procedures, equipment calibration, and employee training help minimize variations and ensure uniformity in product output. Continuous Improvement: Adopting a culture of continuous improvement enables organizations to identify areas for enhancement and implement corrective actions proactively. Feedback mechanisms such as customer surveys and internal audits aid in refining production processes over time. Compliance with Regulations: Adhering to regulatory requirements related to safety, environmental impact, and product certifications is vital for ensuring conformance quality. Non-compliance can lead to legal repercussions and damage brand reputation.

Montgomery (2008) Conformance quality plays a pivotal role in maintaining high production standards, meeting customer expectations, and fostering competitiveness in the marketplace. By prioritizing adherence to specifications, implementing effective quality control measures, ensuring process consistency, promoting continuous improvement, and complying with regulations, manufacturers can enhance their overall production quality.

Performance Quality

Performance quality in terms of production quality refers to the level of excellence achieved in the execution of a particular task or activity within a production process. It encompasses various aspects such as efficiency, effectiveness, reliability, and consistency in delivering outputs that meet or exceed the expectations of stakeholders. In the context of manufacturing and industrial processes, performance quality is crucial for ensuring that products are produced with high standards of precision, accuracy, and consistency. One key aspect of performance quality in production is efficiency, which refers to the ability to achieve maximum output with minimum input resources. This includes optimizing production processes, minimizing waste, reducing downtime, and improving overall productivity. Efficiency is essential for maximizing output while minimizing costs and resources, ultimately leading to higher profitability and competitiveness in the market (Hoyle, 2018).

Montgomery (2008) another important aspect of performance quality in production is effectiveness, which focuses on achieving desired outcomes and meeting customer requirements. This involves producing goods that meet quality standards, specifications, and customer expectations consistently. Effective production quality ensures that products are reliable, durable, safe, and meet regulatory standards. Reliability is also a critical component of performance quality in production. It pertains to the consistency and predictability of production processes in delivering outputs that meet specified requirements. Reliable production systems minimize variability and defects, leading to consistent product quality and customer satisfaction.

Pyzdek (2014) Consistency is another key element of performance quality in production. It involves maintaining uniformity and stability in production processes to ensure that products meet established standards over time. Consistent production quality builds trust with customers and enhances brand reputation by delivering reliable products consistently. In summary, performance quality in terms of production quality encompasses efficiency, effectiveness, reliability, and consistency in manufacturing processes to ensure high-quality outputs that meet customer expectations and regulatory requirements.

Theoretical Review

This study is anchored on Total Quality Management (TQM) theory and supported by Statistical Process Control (SPC) theory and Six Sigma theory.

Total Quality Management (TQM) theory

Total Quality Management (TQM) is a management philosophy that focuses on continuous improvement in all aspects of an organization. The theory of TQM was propounded by W. Edwards Deming, an American statistician, professor, author, lecturer, and consultant. Deming introduced his ideas on quality management in the 1950s and 1960s while working in Japan after World War II. He emphasized the

importance of quality control and statistical methods to improve productivity and reduce waste in manufacturing processes.

Assumptions of the Total Quality Management (TQM) theory include:

- i. **Customer Focus:** TQM emphasizes meeting customer requirements and exceeding their expectations.
- ii. **Continuous Improvement:** TQM advocates for ongoing improvement in processes, products, and services.
- iii. **Employee Involvement:** TQM encourages the involvement of all employees in quality improvement efforts.
- iv. **Process Approach:** TQM focuses on understanding and improving processes to achieve better results.
- v. **Data-Driven Decision Making:** TQM relies on data and statistical analysis to make informed decisions.

Critiques of the Total Quality Management (TQM) theory include:

1. **Implementation Challenges:** Implementing TQM can be difficult due to resistance to change within organizations.
2. **Lack of Flexibility:** Some critics argue that TQM's focus on standardization may hinder innovation and creativity.
3. **Overemphasis on Metrics:** Critics suggest that excessive reliance on metrics may lead to a narrow focus on quantitative measures at the expense of qualitative aspects.
4. **Costly Implementation:** Implementing TQM practices can be costly for organizations, especially small businesses.
5. **Sustainability Concerns:** Critics question the long-term sustainability of TQM initiatives and their ability to adapt to changing market conditions.

Relevance of the theory

The relevance of the Total Quality Management (TQM) theory to the study of raw materials inspection and production quality of manufacturing firms in Rivers State lies in its potential to improve overall operational efficiency, product quality, and customer satisfaction. By adopting TQM principles such as process optimization, employee involvement, and data-driven decision-making, manufacturing firms in Rivers State can enhance their competitiveness, reduce defects in raw materials, improve production quality, and meet customer expectations more effectively (White & Davis, 2016).

Statistical Process Control (SPC) theory

Statistical Process Control (SPC) theory was propounded by Walter A. Shewhart in the 1920s while working at Bell Telephone Laboratories. Shewhart's work laid the foundation for modern quality control and statistical process control methods. The theory of SPC is based on the assumption that variation in processes is natural and can be managed and improved through statistical methods. The key assumptions of SPC include: Processes are stable and predictable over time, Variability in processes can be measured and analyzed using statistical tools, Understanding and controlling variability leads to improved quality and efficiency.

Critiques of the SPC theory include concerns about its applicability to complex systems, potential over-reliance on statistical analysis at the expense of practical knowledge, and challenges in implementation due to organizational resistance or lack of expertise.

The relevance of SPC theory to the study of raw materials inspection and production quality of manufacturing firms in Rivers State lies in its ability to help firms monitor, control, and improve their production processes. By implementing SPC techniques, firms can identify sources of variation in raw materials, detect quality issues early in the production process, and make data-driven decisions to enhance product quality and consistency (Brown, & Jones, 2017).

Six Sigma theory

The theory of Six Sigma was propounded by Motorola engineer Bill Smith in 1986. Six Sigma is a data-driven methodology aimed at improving the quality of processes by identifying and removing causes of defects and minimizing variability in manufacturing and business processes. The main assumptions of the Six Sigma theory include: Processes can be measured, analyzed, improved, and controlled. Variation in processes can lead to defects and errors. By reducing process variation, organizations can improve quality and efficiency. Achieving Six Sigma levels (3.4 defects per million opportunities) is a realistic goal for organizations.

Critiques of the Six Sigma theory include concerns about its overemphasis on statistical tools, potential neglect of customer needs, excessive focus on cost reduction at the expense of innovation, and challenges in sustaining long-term improvements.

In the context of raw materials inspection and production quality in manufacturing firms in Rivers State, Nigeria, the relevance of Six Sigma lies in its potential to enhance operational efficiency, reduce defects in raw materials, improve product quality, increase customer satisfaction, and ultimately drive profitability. By implementing Six Sigma principles such as DMAIC (Define, Measure, Analyze, Improve, Control) methodology and statistical tools like control charts and process capability analysis, manufacturing firms in Rivers State can systematically identify root causes of quality issues, optimize production processes, and ensure consistent quality standards (Smith, et al., 2018).

Empirical Review

Smith et al. (2018) carried out a study on the Impact of Visual Inspection on Production Quality in Manufacturing Firms in Rivers State. Population of the study was Manufacturing firms in Rivers State. Instrument for data collection was Surveys and interviews. Method of data analysis was Statistical analysis, including regression analysis. The study found a significant positive correlation between effective visual inspection practices and higher production quality in manufacturing firms in Rivers State. The study concluded that visual inspection plays a critical role in enhancing production quality and should be prioritized by manufacturing firms. The study recommends that manufacturing firms invest in training their employees on effective visual inspection techniques and implement regular quality control measures to improve production quality.

Oke and Oladele (2018) undertook a study on visual inspection and production quality: A Study of Manufacturing Firms in Nigeria. Population of the study was Manufacturing firms in Nigeria Instrument for data collection: Questionnaires and direct observation Method of data analysis: Statistical analysis using SPSS software. The study found that visual inspection significantly influences the production quality of manufacturing firms in Nigeria. Conclusion: Visual inspection plays a crucial role in ensuring high production quality standards in Nigerian manufacturing firms. The authors recommended that manufacturing firms invest more resources in training personnel for effective visual inspection processes to enhance product quality.

Adeyemi (2018) carried out a study on "Dimensional Inspection and Production Quality: A Study of Manufacturing Firms in Nigeria". Population of the study was Selected manufacturing firms in Nigeria. Instrument for data collection was Questionnaires, interviews. Method of data analysis was Statistical analysis, regression analysis. The study found a significant positive relationship between effective dimensional inspection practices and improved production quality outcomes in Nigerian manufacturing firms. The study concluded that Effective dimensional inspection plays a crucial role in enhancing production quality in Nigerian manufacturing firms. The study recommended that manufacturing firms in Nigeria should invest in advanced dimensional inspection technologies and training programs to improve their production quality standards.

Ogunnaike (2016) carried out a study on dimensional inspection techniques and Product Quality Control in Nigerian Manufacturing Industries. Population of the study was Nigerian manufacturing industries. Instrument for data collection was Surveys, case studies. Method of data analysis was Descriptive statistics, qualitative analysis. The study highlighted the importance of accurate dimensional inspection techniques in ensuring product quality control within Nigerian manufacturing industries. Th study concluded that effective dimensional inspection techniques are essential for maintaining high product quality standards in Nigerian manufacturing industries. The study recommended that Nigerian

manufacturing industries should prioritize investment in advanced dimensional inspection technologies and employee training to enhance product quality control.

METHODOLOGY

Correlational survey research design was adopted for this study as this study seek to determine the relationship between the two variables. The population of this study is thirty two (32) manufacturing companies in Rivers State which are registered with the Rivers state branch of Manufacturers Association of Nigeria (MAN). The sample size for this study is the thirty two (32) manufacturing companies earlier indicated as the population. The study adopted the census techniques. One of the reasons for applying census method is the limited and manageable size of the population. There are only 32 registered firms with MAN in the State. With regard to the respondents of the study given the strategic nature of the study, three key managers (production manager, quality assurance unit manager and logistics manager) were chosen as respondents from each using simple random sampling, of the thirty two firms constitute the study subject. This gave us a total of ninety two (92) for the study. Structured questionnaire instrument title "raw material inspection and production quality of manufacturing firms questionnaire" was developed on five point likert scale .

raw material inspection and production quality of manufacturing firms questionnaire was independently subjected to content and construct validity by an associate professor in the Department of Management, Faculty of Management Sciences, Ignatius Ajuru University of Education, Port Harcourt and a specialist in measurement and evaluation. The corrections and suggestions of the validators were effected on the finale copy of the instrument. The reliability of empirical measurement is indicated by the internal consistency, One of the most commonly used indicators of internal consistency is Cronbach's alpha coefficient. Questionnaire item statements with Cronbach's alpha reliability coefficient below the 0.70 threshold were eliminated. the test-re-test method was used. 10 copies of the questionnaire instrument were issue and some later same copies were issue through electronic media. the results were used in computation using Cronbach's alpha test of reliability.

Table 1: Reliability Statistics

Cronbach's Alpha	N of Items
.708	4

Source: Researcher computation via SPSS version 22

The result of the Cronbach's Alpha reliability test indicates .708 which is above .70 which implies that the items are reliable. Pearson product moment correlation was used to test the hypotheses using SPSS (statistical package social sciences).

Data Analysis

HO₁: There is no significant relationship between visual inspection and conformance quality of manufacturing firms in Rivers State.

Table 2: Correlations on visual inspection and conformance quality

		visual inspection	conformance quality
visual inspection	Pearson Correlation	1	.802**
	Sig. (2-tailed)		.000
	N	92	92
conformance quality	Pearson Correlation	.802**	1
	Sig. (2-tailed)	.000	
	N	92	92

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

Table 2: Correlations on visual inspection and conformance quality revealed that there is a significant relationship between visual inspection and conformance quality of manufacturing firms in Rivers State where (P. 802 = 0.000) leading to the acceptance of alternate hypothesis: There is a significant relationship between visual inspection and conformance quality of manufacturing firms in Rivers State.

HO₂: There is no significant relationship between visual inspection and performance quality of manufacturing firms in Rivers state.

Table 3: Correlations on visual inspection and performance quality

		visual inspection	performance quality
visual inspection	Pearson Correlation	1	.839**
	Sig. (2-tailed)		.000
	N	92	92
performance quality	Pearson Correlation	.839**	1
	Sig. (2-tailed)	.000	
	N	92	92

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

Table 3: Correlations on visual inspection and performance quality revealed that there is a significant relationship between visual inspection and performance quality of manufacturing firms in Rivers State where (P. 839 = 0.000) leading to the acceptance of alternate hypothesis: There is a significant relationship between visual inspection and performance quality of manufacturing firms in Rivers State.

HO₃: There is no significant relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers state.

Table 4: Correlations on dimensional inspection and conformance quality

		dimensional inspection	conformance quality
dimensional inspection	Pearson Correlation	1	.552**
	Sig. (2-tailed)		.000
	N	92	92
conformance quality	Pearson Correlation	.552**	1
	Sig. (2-tailed)	.000	
	N	92	92

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

Table 4: Correlations on dimensional inspection and conformance quality revealed that there is a significant relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers State where (P. 552 = 0.000) leading to the acceptance of alternate hypothesis: There is a significant relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers State.

HO₄: There is no significant relationship between dimensional inspection and performance quality of manufacturing firms in Rivers state.

Table 5: Correlations on dimensional inspection and performance quality

		dimensional inspection	performance quality
dimensional inspection	Pearson Correlation	1	.549**
	Sig. (2-tailed)		.000
	N	92	92
performance quality	Pearson Correlation	.549**	1
	Sig. (2-tailed)	.000	
	N	92	92

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

Table 5: Correlations on dimensional inspection and performance quality revealed that there is a significant relationship between dimensional inspection and performance quality of manufacturing firms in Rivers State where (P. 549 = 0.000) leading to the acceptance of alternate hypothesis: There is a significant relationship between dimensional inspection and performance quality of manufacturing firms in Rivers State.

Discussion of findings

Visual inspection and conformance quality

Table 2: Correlations on visual inspection and conformance quality revealed that there is a significant relationship between visual inspection and conformance quality of manufacturing firms in Rivers State where (P. 802 = 0.000) leading to the acceptance of alternate hypothesis: There is a significant relationship between visual inspection and conformance quality of manufacturing firms in Rivers State. Similarly, Smith et al. (2018) carried out a study on the Impact of Visual Inspection on Production Quality in Manufacturing Firms in Rivers State. The study found a significant positive correlation between effective visual inspection practices and higher production quality in manufacturing firms in Rivers State. The study concluded that visual inspection plays a critical role in enhancing production quality and should be prioritized by manufacturing firms. The study recommends that manufacturing firms invest in training their employees on effective visual inspection techniques and implement regular quality control measures to improve production quality.

Visual inspection and performance quality

Table 3: Correlations on visual inspection and performance quality revealed that there is a significant relationship between visual inspection and performance quality of manufacturing firms in Rivers State where (P. 839 = 0.000) leading to the acceptance of alternate hypothesis: There is a significant relationship between visual inspection and performance quality of manufacturing firms in Rivers State. Similarly, Oke and Oladele (2018) undertook a study on visual inspection and production quality: A Study of Manufacturing Firms in Nigeria. The study found that visual inspection significantly influences the production quality of manufacturing firms in Nigeria. Conclusion: Visual inspection plays a crucial role in ensuring high production quality standards in Nigerian manufacturing firms. The authors recommended that manufacturing firms invest more resources in training personnel for effective visual inspection processes to enhance product quality.

Dimensional inspection and conformance quality

Table 4: Correlations on dimensional inspection and conformance quality revealed that there is a significant relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers State where (P. 552 = 0.000) leading to the acceptance of alternate hypothesis: There is a significant relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers State. Similarly, Adeyemi (2018) carried out a study on "Dimensional Inspection and Production Quality: A Study of Manufacturing Firms in Nigeria". The study found a significant positive relationship

between effective dimensional inspection practices and improved production quality outcomes in Nigerian manufacturing firms. The study concluded that Effective dimensional inspection plays a crucial role in enhancing production quality in Nigerian manufacturing firms. The study recommended that manufacturing firms in Nigeria should invest in advanced dimensional inspection technologies and training programs to improve their production quality standards.

Dimensional inspection and performance quality

Table 5: Correlations on dimensional inspection and performance quality revealed that there is a significant relationship between dimensional inspection and performance quality of manufacturing firms in Rivers State where $(P. 549 = 0.000)$ leading to the acceptance of alternate hypothesis: There is a significant relationship between dimensional inspection and performance quality of manufacturing firms in Rivers State. Ogunnaike (2016) carried out a study on dimensional inspection techniques and Product Quality Control in Nigerian Manufacturing Industries. The study highlighted the importance of accurate dimensional inspection techniques in ensuring product quality control within Nigerian manufacturing industries. Th study concluded that effective dimensional inspection techniques are essential for maintaining high product quality standards in Nigerian manufacturing industries. The study recommended that Nigerian manufacturing industries should prioritize investment in advanced dimensional inspection technologies and employee training to enhance product quality control.

Summary of findings

1. There is a significant relationship between visual inspection and conformance quality of manufacturing firms in Rivers State.
2. There is a significant relationship between visual inspection and performance quality of manufacturing firms in Rivers state.
3. There is a significant relationship between dimensional inspection and conformance quality of manufacturing firms in Rivers state.
4. There is a significant relationship between dimensional inspection and performance quality of manufacturing firms in Rivers state.

CONCLUSION

The study concluded that there is positive relationship between raw materials inspection and production quality of manufacturing firms in Rivers State. In conclusion, raw materials inspection, including visual and dimensional inspections, is a critical aspect of ensuring the production quality of manufacturing firms in Rivers State. Visual inspection involves examining raw materials for any visible defects or irregularities, while dimensional inspection focuses on verifying the physical dimensions of the materials. By implementing thorough inspection processes, manufacturing firms can identify and address any issues with raw materials before they impact the quality of the final products.

RECOMMENDATIONS

The following recommendations were drawn from the findings of the study.

1. Implement a comprehensive raw materials inspection process that includes both visual and dimensional inspections to ensure the quality and consistency of incoming materials.
2. Invest in training for staff members involved in raw materials inspection to improve their ability to identify potential issues and make informed decisions.
3. Regularly review and update inspection procedures to incorporate industry best practices and address any emerging challenges in raw materials quality.
4. Establish clear communication channels between the inspection team and other departments involved in the production process to facilitate timely resolution of any issues identified during inspection.

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APPENDIX A
Letter of Introduction

I am a Ph.D student in Ignatius Ajuru university of Education, faculty of management sciences, Department of Management, production and operation management option. I am carrying out a study on **RAW MATERIALS INSPECTION AND PRODUCTION QUALITY OF MANUFACTURING FIRMS IN RIVERS STATE** will appreciate your honest response as it will be confidential and strictly for academic purposes only.

NOTE: strongly agree (SA) =5; agree (A) = 4; undecided (U) = 3; disagree (D) =2; strongly disagree (SD) =1

SECTION B: RAW MATERIAL INSPECTION

S/N	Item Statement	SA	A	U	SD	D
1.	Do you believe that the current visual inspection procedures adequately identify surface defects in raw materials?					
2.	How often do you encounter discrepancies between the actual dimensions of raw materials and the specified dimensions?					
3.	How satisfied are you with the overall effectiveness of the dimensional inspection process for raw materials?					
4	Have you received adequate training on conducting visual inspections and dimensional inspections for raw materials?					

SECTION C: PRODUCTION QUALITY

S/N	Item Statement	SA	A	U	SD	D
1	To what extent do you believe that the products manufactured by our company meet the established quality standards?					
2	How satisfied are you with the consistency of product specifications being met during the manufacturing process?					
3	How often do you encounter defects or non-conformities in the products received from our company?					
4	How likely are you to recommend our products to others based on their quality and performance?					

APPENDIX B
SPSS OUTPUT

Warning # 849 in column 23. Text: en_NG

The LOCALE subcommand of the SET command has an invalid parameter. It could not be mapped to a valid backend locale.

CORRELATIONS

```
/VARIABLES=VAR00001 VAR00002
/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
```

Correlations**Notes**

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Comments		
Input	Active Dataset	DataSet0
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	92
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=VAR00001 VAR00002 /PRINT=TWOTAIL NOSIG /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.03

[DataSet0]

Correlations

		visual inspection	conformance quality
visual inspection	Pearson Correlation	1	.802**
	Sig. (2-tailed)		.000
	N	92	92
conformance quality	Pearson Correlation	.802**	1
	Sig. (2-tailed)	.000	
	N	92	92

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

CORRELATIONS

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/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
```

Correlations**Notes**

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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=VAR00001 VAR00002 /PRINT=TWOTAIL NOSIG /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.05

Correlations

		visual inspection	performance quality
visual inspection	Pearson Correlation	1	.839**
	Sig. (2-tailed)		.000
	N	92	92
performance quality	Pearson Correlation	.839**	1
	Sig. (2-tailed)	.000	
	N	92	92

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

CORRELATIONS

```
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/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
```

Correlations**Notes**

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Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.

	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=VAR00001 VAR00002 /PRINT=TWOTAIL NOSIG /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.13

Correlations

		dimensional inspection	conformance quality
dimensional inspection	Pearson Correlation	1	.552**
	Sig. (2-tailed)		.000
	N	92	92
conformance quality	Pearson Correlation	.552**	1
	Sig. (2-tailed)	.000	
	N	92	92

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

CORRELATIONS

/VARIABLES=VAR00001 VAR00002
/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.

Correlations

Notes

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Comments		
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	N of Rows in Working Data File	92
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=VAR00001 VAR00002 /PRINT=TWOTAIL NOSIG /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.11

Correlations

		dimensional inspection	performance quality
dimensional inspection	Pearson Correlation	1	.549**
	Sig. (2-tailed)		.000
	N	92	92
performance quality	Pearson Correlation	.549**	1
	Sig. (2-tailed)	.000	
	N	92	92

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