

## THE EFFECT OF MINIMIZING DEFECTIVE PRODUCTS THROUGH EFFECTIVE PRODUCTION PLANNING AND CONTROL OF MANUFACTURING FIRMS IN RIVERS STATE

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### ABSTRACT

*This study examine the effect of minimizing defective products through effective production planning and control of manufacturing firms in Rivers State. descriptive survey research design was adopted for this study as this study seek to determine the influence of one variable over the other. 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, manager, quality assurance unit 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" minimizing defective products for effective production planning and control in 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. regression analysis was used to test the hypotheses using spss (statistical package social sciences). The study revealed that quality control inspection significantly influences capacity planning of manufacturing firms in Rivers state. Quality control inspection significantly influences production scheduling of manufacturing firms in Rivers state. Continuous improvement process significantly influences capacity planning of manufacturing firms in Rivers state. Continuous improvement process significantly influences production scheduling of manufacturing firms in Rivers state. The study concluded that minimizing defective products significantly influence effective production planning and control of manufacturing firms in Rivers State. The study recommended that manufacturing firms should implement a comprehensive quality management system that includes regular quality audits, training programs for employees, and continuous improvement initiatives to enhance product quality.*

### INTRODUCTION

#### Background to the Study

Minimizing defective products is a crucial aspect of ensuring the quality and efficiency of manufacturing processes in any industry. Defective products not only lead to financial losses for manufacturing firms but also damage their reputation and customer trust. Effective production planning and control play a significant role in reducing defects by optimizing resources, streamlining processes, and ensuring adherence to quality standards. In the context of manufacturing firms in Rivers State, Nigeria, where industries such as oil and gas, agriculture, and construction are prominent, the need to minimize defective products is paramount. The state's economy heavily relies on these industries, making it essential for manufacturing firms to adopt strategies that enhance product quality and reduce defects (Stevenson, 2018).

Chase, et al., (2018) Quality control inspections and continuous improvement processes are essential components of ensuring the production of high-quality products with minimal defects. Quality control inspections involve systematic checks and evaluations of products at various stages of production to identify and rectify any defects or deviations from quality standards. These inspections help in preventing defective products from reaching customers, thereby reducing costs

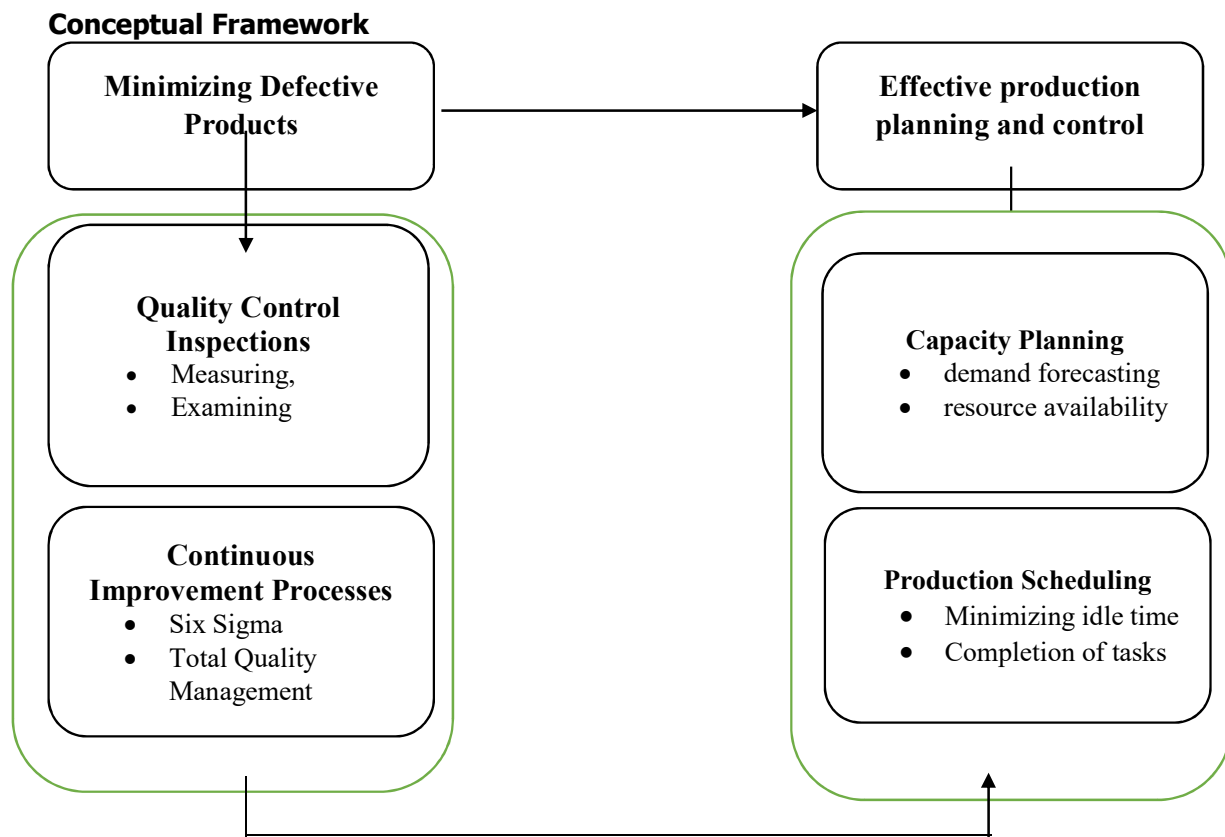
associated with rework, returns, and customer complaints. Continuous improvement processes, on the other hand, focus on identifying areas for improvement in the production process to enhance efficiency, reduce waste, and optimize product quality. By continuously monitoring and analyzing production processes, companies can implement corrective actions to prevent defects from occurring in the first place. The combination of quality control inspections and continuous improvement processes forms a robust quality management system that aims to minimize defective products, improve customer satisfaction, and enhance overall business performance. Companies that prioritize quality control and continuous improvement are better positioned to compete in the market by offering reliable products that meet or exceed customer expectations.

Slack, et al., (2019) Effective production planning involves forecasting demand accurately, scheduling production activities efficiently, and allocating resources effectively. By implementing robust production planning strategies, manufacturing firms can anticipate potential issues that may lead to defects and take proactive measures to address them. Production control is equally important in minimizing defective products as it involves monitoring production processes, identifying deviations from standards, and taking corrective actions promptly. Through effective production control mechanisms such as real-time monitoring systems and quality assurance protocols, manufacturing firms can detect defects early in the production cycle and prevent them from escalating.

By conducting a study on minimizing defective products through effective production planning and control in manufacturing firms in Rivers State, researchers aim to identify best practices, challenges, and opportunities for improvement in this area. The findings of this study will provide valuable insights for industry stakeholders, policymakers, and academics seeking to enhance the competitiveness and sustainability of manufacturing operations in the region. Various studies have been carried out on minimizing defective products through effective production planning and control of manufacturing firms in Nigeria however , it is observed that there are scare literatures on minimizing defective products through effective production planning and control of manufacturing firms in Rivers State, it is in the light of the above that this study is carried out to fill this lacuna by determining the influence of minimizing defective products through effective production planning and control of manufacturing firms in Rivers State.

### **Statement of the problem**

Minimizing defective products through effective production planning and control is crucial for manufacturing firms in Rivers State, Nigeria. However, several problems can affect the study and implementation of strategies to achieve this goal. Some of the key issues that may hinder the successful minimization of defective products include: Lack of Proper Infrastructure: Inadequate infrastructure such as unreliable power supply, poor transportation networks, and limited access to technology can hamper effective production planning and control in manufacturing firms. A shortage of skilled labor in areas such as engineering, quality control, and supply chain management can lead to errors in production processes and an increase in defective products (Heizer, & Render, 2016). Poor coordination among suppliers, manufacturers, and distributors can result in delays, disruptions, and inconsistencies in the production process, leading to defects in the final products. Insufficient quality control measures or ineffective implementation of quality assurance protocols can result in a higher rate of defective products reaching the market. Without access to accurate data and analytics tools, manufacturing firms may struggle to identify patterns or trends that could help them improve their production planning and control processes to minimize defects (Schroeder, et al.,2012). Overall, addressing these challenges is essential for manufacturing firms in Rivers State to enhance their competitiveness, improve product quality, and reduce costs associated with defective products.



**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 influence of minimizing defective products through effective production planning and control of manufacturing firms in Rivers State. The specific objectives of the study were to:

- 1) determine the influence of quality control inspection on capacity planning of manufacturing firms in Rivers state.
- 2) ascertain the influence of quality control inspection on production scheduling of manufacturing firms in Rivers state.
- 3) determine the influence of continuous improvement process on capacity planning of manufacturing firms in Rivers state.
- 4) ascertain the influence of continuous improvement process on production scheduling of manufacturing firms in Rivers state.

### Research Questions

The following research questions were raised to guide the study.

- 1) What is the influence of quality control inspection on capacity planning of manufacturing firms in Rivers state?
- 2) What is the influence of quality control inspection on production scheduling of manufacturing firms in Rivers state?
- 3) What is the influence of continuous improvement process on capacity planning of manufacturing firms in Rivers state?

- 4) What is the influence of continuous improvement process on production scheduling of manufacturing firms in Rivers state?

### Research Hypotheses

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

**HO<sub>1</sub>:** quality control inspection does not significantly influence capacity planning of manufacturing firms in Rivers state.

**HO<sub>2</sub>:** quality control inspection does not significantly influence production scheduling of manufacturing firms in Rivers state.

**HO<sub>3</sub>:** continuous improvement process does not significantly influence capacity planning of manufacturing firms in Rivers state.

**HO<sub>4</sub>:** continuous improvement process does not significantly influence production scheduling of manufacturing firms in Rivers state.

### Significance of the study

The study on minimizing defective products through effective production planning and control of manufacturing firms in Rivers State is of significant importance for several reasons. Defective products can have detrimental effects on a company's reputation, customer satisfaction, and financial performance. By implementing efficient production planning and control measures, manufacturing firms can reduce the occurrence of defects in their products, leading to improved quality, increased customer satisfaction, and higher profitability.

Effective production planning involves determining the resources needed for production, scheduling tasks, and optimizing processes to meet production goals efficiently. Production control focuses on monitoring and regulating the production processes to ensure that they are carried out as planned and that quality standards are met. By integrating these two functions effectively, manufacturing firms can minimize defects in their products and enhance overall operational efficiency.

The categories of persons who will benefit from this study include:

- i. **Manufacturing Managers:** They can use the findings to improve their production planning and control strategies to minimize defective products.
- ii. **Quality Control Personnel:** They can gain insights into how effective production planning and control can help in reducing defects.
- iii. **Operations Managers:** They can learn about best practices in production planning and control to enhance product quality.
- iv. **Supply Chain Managers:** They can understand the importance of efficient production planning in ensuring a smooth supply chain process.
- v. **Researchers and Academicians:** They can use the study's results for further research in the field of production management.

### LITERATURE REVIEW

This section review various extant literature related to the study under investigation under the headings of conceptual clarification, theoretical underpinning and empirical review.

#### Conceptual Clarification

##### Minimizing defective products

Heizer, et al., (2016) Minimizing defective products is a crucial aspect of quality management in manufacturing industries. Defective products can lead to customer dissatisfaction, increased costs for rework or replacements, damage to the company's reputation, and potential legal issues. To minimize defective products, companies implement various strategies and quality control measures throughout the production process. One key strategy to minimize defective products is implementing a robust quality management system. This involves setting quality standards, conducting regular inspections and audits, providing employee training on quality control procedures, and continuously

monitoring and improving processes to prevent defects from occurring. Another important approach is implementing statistical process control (SPC) techniques. SPC involves using statistical methods to monitor and control production processes, identify variations that could lead to defects, and take corrective actions before defects occur. Additionally, companies can utilize tools such as Failure Mode and Effects Analysis (FMEA) to proactively identify potential failure modes in the production process and develop mitigation strategies to prevent defects.

Schroeder, et al., (2012) Regular maintenance of equipment and machinery is also essential in minimizing defective products. Ensuring that machines are properly maintained can help prevent breakdowns or malfunctions that could result in defects in the final product. Furthermore, fostering a culture of quality within the organization is vital. Encouraging employees to take ownership of quality, emphasizing the importance of producing defect-free products, and rewarding excellence in quality performance can all contribute to minimizing defective products. In conclusion, minimizing defective products requires a comprehensive approach that encompasses setting quality standards, implementing quality management systems, utilizing statistical process control techniques, conducting proactive risk assessments, maintaining equipment regularly, and fostering a culture of quality within the organization.

Heizer, et al., (2016) Minimizing defective products is crucial for businesses across various industries as it offers a multitude of benefits that can positively impact the company's bottom line, reputation, and customer satisfaction. Some of the key benefits of minimizing defective products include: Cost Savings: One of the primary benefits of minimizing defective products is cost savings. By reducing the number of defects in products, companies can save money on rework, scrap, warranty claims, and customer returns. This leads to improved profitability and efficiency within the organization.

Stevenson (2018) minimizing defective products results in higher overall product quality. This can lead to increased customer satisfaction, loyalty, and retention. Customers are more likely to trust and continue purchasing from a company that consistently delivers high-quality products. Companies that prioritize minimizing defective products tend to have a better reputation in the market. A strong reputation for quality and reliability can attract new customers and help retain existing ones. Positive word-of-mouth referrals can also increase brand awareness and credibility.

Stevenson (2018) minimizing defective products helps companies comply with industry regulations and standards. By ensuring that products meet quality requirements, businesses can avoid costly fines, penalties, or legal issues associated with non-compliance. Companies that minimize defective products gain a competitive edge in the market. High-quality products differentiate them from competitors and position them as industry leaders. This competitive advantage can drive business growth and long-term success. Overall, minimizing defective products is essential for achieving operational excellence, maintaining customer satisfaction, and sustaining a successful business in today's competitive marketplace.

## **Dimensions of minimizing defective product**

### **Quality Control Inspection**

Schroeder, et al., (2012) Quality control inspection is a crucial process in manufacturing and production industries to ensure that products meet the required standards of quality. It involves systematic checks, tests, and evaluations of products to identify any defects or deviations from specifications. Quality control inspection aims to prevent defective products from reaching customers, maintain consistency in product quality, and improve overall efficiency in the production process.

Montgomery (2008) the quality control inspection process typically involves several key steps: Planning: Establishing clear quality standards and criteria for inspection based on product specifications and customer requirements. Sampling: Selecting representative samples from the production batch for inspection to assess the overall quality of the entire batch. Inspection:

Conducting visual inspections, measurements, tests, and other evaluation methods to identify defects or deviations from quality standards. Analysis: Analyzing inspection results to determine the root causes of defects and take corrective actions to address them. Reporting: Documenting inspection findings, including any defects found, corrective actions taken, and recommendations for process improvement. Follow-up: Monitoring the effectiveness of corrective actions and implementing preventive measures to avoid similar issues in future production runs.

Pyzdek and Paul (2014) Quality control inspection plays a vital role in ensuring customer satisfaction, maintaining brand reputation, and complying with regulatory requirements. By identifying and addressing quality issues early in the production process, companies can minimize waste, reduce rework costs, and enhance overall product reliability. Overall, quality control inspection is a proactive approach that helps organizations deliver high-quality products consistently while meeting customer expectations and regulatory standards. Quality control inspection is a crucial process in manufacturing and production industries that ensures products meet specific quality standards before they are released to the market. This process involves systematic checks, tests, and evaluations of products to identify any defects or deviations from the desired specifications. Quality control inspection aims to prevent defective products from reaching consumers, thereby maintaining customer satisfaction and protecting a company's reputation.

Oakland (2003) the first step in quality control inspection is establishing clear quality standards based on product requirements and industry regulations. These standards serve as benchmarks for evaluating the quality of products during inspection. Inspection procedures are then developed to systematically examine various aspects of the product, such as dimensions, materials, functionality, and performance. Inspectors use a variety of tools and techniques, including visual inspections, measurements, testing equipment, and sampling methods, to assess product quality accurately. During the inspection process, inspectors carefully examine each product to identify any defects or non-conformities. Defects can range from minor cosmetic issues to critical flaws that affect product safety or functionality. Inspectors document their findings and categorize defects based on severity and impact on product quality. Depending on the type of defect detected, corrective actions may be taken to address the issues before products are approved for release.

Quality control inspection can take place at different stages of the production process, including incoming materials inspection, in-process inspection, and final product inspection. By conducting inspections at multiple stages, manufacturers can identify and rectify quality issues early on, reducing the likelihood of producing defective products. Continuous monitoring and improvement of inspection processes are essential for ensuring consistent product quality and meeting customer expectations. In conclusion, quality control inspection plays a vital role in maintaining high product quality standards and ensuring customer satisfaction in manufacturing industries. By implementing robust inspection procedures and continuously improving quality control processes, companies can enhance their competitiveness in the market and build a strong reputation for delivering reliable products (Goetsch, & Stanley 2014).

### **Continuous Improvement Process**

Continuous Improvement Process (CIP) in manufacturing firms is a systematic approach that aims to enhance efficiency, quality, and productivity through ongoing incremental changes. This process involves identifying areas for improvement, implementing changes, measuring outcomes, and then repeating the cycle to achieve continuous enhancement. CIP is crucial for manufacturing firms to stay competitive in the ever-evolving market by adapting to changing customer demands, technological advancements, and industry trends. One of the key principles of CIP is the involvement of employees at all levels of the organization. By empowering employees to identify problems and suggest solutions, manufacturing firms can tap into their collective knowledge and experience to drive improvements. This participatory approach not only leads to better problem-solving but also fosters a culture of continuous learning and innovation within the organization (Oakland, 2003).

Montgomery (2008) another important aspect of CIP is the use of data-driven decision-making. Manufacturing firms collect and analyze data on various performance metrics such as production output, defect rates, downtime, and customer satisfaction to identify areas that need improvement. By using data analytics tools and techniques, firms can gain valuable insights into their processes and make informed decisions on how to optimize them for better results. Furthermore, CIP involves the implementation of lean manufacturing principles such as just-in-time production, waste reduction, and value stream mapping. These principles help streamline operations, eliminate inefficiencies, and create a more agile and responsive manufacturing environment. By continuously seeking ways to eliminate waste and improve processes, manufacturing firms can achieve higher levels of productivity and profitability.

Pyzdek and Paul (2014) Continuous Improvement Process is a fundamental strategy for manufacturing firms looking to enhance their competitiveness, adaptability, and sustainability in today's dynamic business landscape. By fostering a culture of continuous improvement, leveraging employee expertise, utilizing data-driven insights, and embracing lean principles, manufacturing firms can achieve operational excellence and drive long-term success.

### **Effective production planning and control**

Effective production planning and control in manufacturing firms is crucial for ensuring smooth operations, maximizing efficiency, and meeting customer demands. Production planning involves determining what products to produce, how much to produce, and when to produce them. On the other hand, production control involves monitoring and regulating the production processes to ensure that they align with the planned objectives. One key aspect of effective production planning and control is forecasting demand accurately. By analyzing historical data, market trends, and customer preferences, manufacturing firms can predict future demand more precisely. This allows them to adjust their production schedules accordingly, minimizing inventory costs and avoiding stockouts (Stevenson, 2018).

Vollmann (2016) another important factor is optimizing production processes. This includes streamlining workflows, reducing bottlenecks, and improving resource utilization. By implementing lean manufacturing principles and adopting advanced technologies such as automation and robotics, firms can enhance productivity and reduce lead times. Furthermore, effective communication and coordination among different departments are essential for successful production planning and control. Clear channels of communication between sales, marketing, production, and procurement teams help in aligning goals and resolving any conflicts that may arise during the production process. Jacobs et al., (2017) Moreover, monitoring key performance indicators (KPIs) regularly enables firms to track their progress towards achieving production targets. By analyzing KPIs such as cycle time, throughput, and capacity utilization, managers can identify areas for improvement and take corrective actions promptly. In conclusion, effective production planning and control are vital for the success of manufacturing firms. By forecasting demand accurately, optimizing production processes, fostering communication among departments, and monitoring KPIs diligently, firms can enhance their operational efficiency, reduce costs, and deliver high-quality products to customers on time (Chopra & Meindl 2018).

### **Measures of Effective production planning and control**

#### **Capacity Planning**

Capacity planning and control are crucial aspects of operations management in manufacturing firms. Capacity planning involves determining the production capacity needed by an organization to meet changing demands for its products. It aims to balance the production capacity with market demand to ensure optimal utilization of resources while meeting customer needs. Effective capacity planning helps in avoiding underutilization or overutilization of resources, which can lead to inefficiencies and increased costs. In manufacturing firms, capacity planning starts with forecasting future demand based on historical data, market trends, and other relevant factors. This forecast is then used to

determine the required production capacity in terms of machinery, labor, and other resources. Once the required capacity is identified, firms need to plan how to acquire, allocate, and utilize these resources efficiently (Chopra & Meindl 2018).

Capacity control, on the other hand, involves monitoring and adjusting the production capacity to ensure that it aligns with actual demand. This process includes tracking key performance indicators such as utilization rates, cycle times, and lead times to identify bottlenecks or inefficiencies in the production process. By having effective control mechanisms in place, manufacturing firms can make real-time adjustments to optimize their capacity utilization and meet changing market demands (Chopra & Meindl 2018). Several strategies can be employed for effective capacity planning and control in manufacturing firms. These include investing in flexible production technologies that can adapt to changing demand patterns, implementing lean manufacturing principles to eliminate waste and improve efficiency, and establishing robust supply chain networks to support fluctuating production needs. Overall, capacity planning and control play a critical role in ensuring the competitiveness and sustainability of manufacturing firms by enabling them to respond effectively to market dynamics while maximizing resource utilization (Muhlemann et al.,2019).

### **Production Scheduling**

Production scheduling and control in manufacturing firms are crucial aspects of operations management that involve planning, organizing, and overseeing the production process to ensure efficiency, timely delivery, and cost-effectiveness. Production scheduling refers to the process of determining when and how each task in the production process will be performed, while production control involves monitoring and regulating the actual production activities to ensure they align with the planned schedule. In manufacturing firms, production scheduling starts with forecasting demand based on historical data, market trends, and customer orders. This information is used to create a production schedule that outlines the sequence of tasks, resources needed, and timelines for each operation. Factors such as machine capacity, labor availability, material availability, and lead times are considered during scheduling to optimize resource utilization and minimize idle time (Jacobs et al.,2017).

Chopra and Meindl (2018) Once the production schedule is established, production control comes into play to ensure that operations are carried out according to plan. This involves tracking progress, identifying bottlenecks or delays, making real-time adjustments as needed, and resolving any issues that may arise during production. Production control also includes quality control measures to maintain product standards and compliance with regulations.

Stevenson (2018) effective production scheduling and control in manufacturing firms can lead to several benefits such as improved productivity, reduced lead times, lower costs, better resource utilization, increased customer satisfaction, and competitive advantage in the market. However, challenges such as unexpected disruptions, changing customer demands, supply chain issues, and limited resources can impact production schedules and require agile responses from managers. Overall, production scheduling and control play a vital role in ensuring smooth operations in manufacturing firms by balancing demand with capacity, optimizing resources efficiently, maintaining quality standards, and meeting customer expectations.

### **Theoretical Underpinning**

**This study was anchored on** Total Quality Management (TQM) theory and supported by Failure Mode and Effects Analysis (FMEA) theory and Lean Manufacturing theory.

#### **Total Quality Management (TQM) Theory**

Total Quality Management (TQM) Theory was propounded by W. Edwards Deming in the 1950s. Deming, an American statistician, engineer, and management consultant, is widely regarded as the father of TQM. He introduced the concept of TQM in Japan after World War II and played a significant role in the country's economic recovery.

**Assumptions of Total Quality Management (TQM) Theory:**

- i. Customer Focus: TQM emphasizes meeting customer needs and expectations by delivering high-quality products and services.
- ii. Continuous Improvement: The theory assumes that organizations should continuously strive to improve their processes and products to achieve excellence.
- iii. Employee Involvement: TQM believes that involving employees at all levels in decision-making and problem-solving leads to better quality outcomes.
- iv. Process Approach: TQM focuses on understanding and improving processes rather than blaming individuals for errors or defects.
- v. Data-Driven Decision Making: The theory assumes that decisions should be based on data and analysis rather than intuition or guesswork.

**Critiques of Total Quality Management (TQM) Theory:**

- i. Implementation Challenges: Critics argue that implementing TQM can be costly and time-consuming, especially for large organizations with complex processes.
- ii. Overemphasis on Metrics: Some critics believe that TQM places too much emphasis on quantitative metrics, which may lead to neglecting qualitative aspects of quality.
- iii. Resistance to Change: Implementing TQM often requires a cultural shift within organizations, and resistance to change from employees can hinder its effectiveness.
- iv. Lack of Innovation: Critics suggest that focusing too much on process improvement may stifle innovation within organizations.
- v. Inflexibility: Some critics argue that TQM's rigid adherence to quality standards may limit adaptability in rapidly changing business environments.

**Relevance of the theory to the Study**

Relevance of Total Quality Management (TQM) Theory to Minimizing Defective Products Through Effective Production Planning and Control in Manufacturing Firms in Rivers State: The principles of TQM can be highly relevant to manufacturing firms in Rivers State seeking to minimize defective products through effective production planning and control. By adopting TQM practices such as continuous improvement, employee involvement, and a process-oriented approach, these firms can enhance product quality, reduce defects, increase customer satisfaction, and ultimately improve their competitiveness in the market. Implementing TQM can help identify root causes of defects, streamline production processes, optimize resource utilization, and foster a culture of quality consciousness among employees. TQM is a management approach that focuses on continuous improvement of product quality and processes. By implementing TQM principles, manufacturing firms can reduce defects and enhance overall product quality.

**Failure Mode and Effects Analysis (FMEA) Theory**

Failure Mode and Effects Analysis (FMEA) Theory was propounded by the United States military in the 1940s. It was initially developed to improve military systems, but it has since been widely adopted in various industries to identify and prioritize potential failure modes in a system or process. FMEA is a systematic approach used to evaluate and mitigate risks associated with product or process failures. The theory assumes that failures can be identified and prevented through proactive analysis, leading to improved reliability and performance of products or processes.

One of the main critiques of FMEA is that it can be time-consuming and resource-intensive to implement, especially for complex systems or processes. Critics argue that FMEA may not always capture all potential failure modes or their effects, leading to gaps in risk assessment. Additionally, some critics suggest that FMEA may focus too much on identifying failures rather than addressing underlying systemic issues that contribute to failures.

**Relevance of the theory to the study**

The relevance of FMEA theory to the study of minimizing defective products through effective production planning and control of manufacturing firms in Rivers State lies in its ability to proactively identify potential failure modes and their effects before they occur. By conducting an FMEA analysis, manufacturing firms can systematically assess risks associated with their production processes, prioritize areas for improvement, and implement preventive measures to minimize defects in their products. This can lead to improved product quality, reduced costs associated with rework or recalls, and enhanced customer satisfaction. FMEA is a proactive approach to identifying and addressing potential failure modes in products or processes. By conducting FMEA analyses, manufacturing firms can anticipate potential defects and implement preventive measures to minimize their occurrence.

**Lean Manufacturing theory**

Lean Manufacturing theory was propounded by Taiichi Ohno, a Japanese industrial engineer and businessman, in the 1950s at Toyota Motor Corporation. The theory is also known as the Toyota Production System (TPS) and has since been widely adopted by manufacturing firms around the world.

**Assumptions of Lean Manufacturing theory include:**

1. Elimination of waste: The primary goal of Lean Manufacturing is to eliminate waste in all forms, including overproduction, waiting time, transportation, excess inventory, motion, defects, and underutilized talent.
2. Continuous improvement: The theory emphasizes the importance of continuous improvement through small incremental changes in processes and systems.
3. Respect for people: Lean Manufacturing values the input and expertise of all employees and encourages a culture of respect and collaboration.
4. Pull-based production: Production is based on customer demand rather than forecasted projections, leading to reduced inventory levels and improved responsiveness to market changes.
5. Just-in-time production: Materials are delivered to the production line exactly when they are needed, minimizing storage costs and reducing lead times.

**Critiques of Lean Manufacturing theory include:**

1. Overemphasis on cost-cutting: Critics argue that Lean Manufacturing sometimes leads to short-term cost-cutting measures that may compromise long-term quality and sustainability.
2. Lack of flexibility: The rigid structure of Lean Manufacturing may limit a company's ability to quickly adapt to changing market conditions or unexpected disruptions.
3. Employee burnout: The relentless pursuit of efficiency in Lean Manufacturing can put excessive pressure on employees and lead to burnout or disengagement.
4. Inadequate focus on innovation: Some critics argue that Lean Manufacturing's focus on incremental improvements may hinder innovation and creativity within an organization.
5. Cultural challenges: Implementing Lean Manufacturing requires a significant cultural shift within an organization, which can be difficult to achieve in practice.

**Relevance of the theory to the study**

The relevance of Lean Manufacturing theory to the study of minimizing defective products through effective production planning and control in manufacturing firms in Rivers State lies in its emphasis on waste reduction, continuous improvement, and quality control. By implementing Lean principles such as error-proofing processes, standardizing work procedures, and empowering employees to identify and address defects early in the production process, manufacturing firms in Rivers State can improve product quality, reduce defects, and enhance overall operational efficiency. Lean manufacturing is a systematic approach to minimizing waste and maximizing efficiency in production

processes. By eliminating waste and streamlining operations, manufacturing firms can reduce defects and improve product quality.

### **Empirical Review**

Oke, et al. (2017) carried out a study on Quality Control Inspection Influence on Effective Production Planning and Control: A Study of Manufacturing Firms in Nigeria Population: Manufacturing firms in Nigeria Instrument for data collection: Surveys, interviews, and observations Findings: The study found a significant positive correlation between the implementation of quality control inspections and the effectiveness of production planning and control in manufacturing firms in Nigeria. Companies that invested in quality control measures experienced improved operational efficiency, reduced defects, and enhanced customer satisfaction. Conclusion: Quality control inspections play a crucial role in enhancing production planning and control processes in Nigerian manufacturing firms. Implementing robust quality control measures can lead to improved product quality, reduced costs, and increased competitiveness. Recommendations: The study recommended that manufacturing firms in Nigeria prioritize quality control inspections as part of their production planning strategies. Investing in training programs for employees involved in quality assurance, adopting modern inspection technologies, and fostering a culture of continuous improvement were suggested as key steps to enhance the effectiveness of quality control practices.

Oke, and Oladele, (2018) carried out a study on the Impact of Quality Control Inspection on Effective Production Planning and Control in Manufacturing Firms in Nigeria. Population of the study was Manufacturing firms in Nigeria. Instrument for Data Collection was Surveys and interviews. The study found that a well-implemented quality control inspection system positively influences effective production planning and control in manufacturing firms in Nigeria. Companies that prioritized quality control inspection experienced higher levels of operational efficiency and customer satisfaction. The study concluded that Quality control inspection plays a crucial role in enhancing production planning and control processes within manufacturing firms, leading to improved overall performance. The authors recommended that manufacturing firms in Nigeria should invest in robust quality control inspection mechanisms to optimize their production planning and control activities.

One such study was carried out by Oke, et al., in 2018 titled "Continuous Improvement Process and Effective Production Planning and Control: A Study of Manufacturing Firms in Nigeria." The population of the study included manufacturing firms in Nigeria. The instrument used for data collection was a structured questionnaire. The findings revealed that the implementation of continuous improvement processes significantly improved production planning and control in the manufacturing firms studied. The conclusion drawn was that continuous improvement is crucial for enhancing production planning and control in Nigerian manufacturing firms. The recommendation provided was for manufacturing firms to prioritize continuous improvement initiatives to optimize their production planning and control processes.

Oke, et al., (2016) carried out a study on "Continuous improvement practices in manufacturing firms in Nigeria" Population: Manufacturing firms in Nigeria Instrument for data collection: Questionnaires and interviews Findings: The study found that continuous improvement practices were positively associated with improved production planning and control in manufacturing firms in Nigeria. The study concluded that Continuous improvement practices play a crucial role in enhancing production planning and control in Nigerian manufacturing firms. Recommendations: The authors recommended that manufacturing firms in Nigeria should prioritize the implementation of continuous improvement practices to enhance their production planning and control processes.

### **METHODOLOGY**

Descriptive survey research design was adopted for this study as this study seek to determine the influence of one variable over the other. 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, manager, quality assurance unit 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 "minimizing defective products for effective production planning and control in manufacturing firms questionnaire" was developed on five point likert scale .

minimizing defective products for effective production planning and control in manufacturing firms questionnaire was independently subjected to content and construct validity by three Lecturers in the Department of Management, Faculty of Management Sciences, Ignatius Ajuru University of Education, Port Harcourt. 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 25**

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

#### Data analysis

**HO<sub>1</sub>:** quality control inspection does not significantly influence capacity planning of manufacturing firms in Rivers state.

**Table 2: Model Summary on quality control inspection significantly influence capacity planning**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.545 <sup>a</sup>	.297	.289	.954

a. Predictors: (Constant), quality control inspection

Table 2: Model Summary on quality control inspection significantly influence capacity planning revealed that quality control inspection significantly influence capacity planning of manufacturing firms in Rivers state (where R = .545 = 54%) therefore leading to acceptance of the alternate hypothesis : quality control inspection significantly influence capacity planning of manufacturing firms in Rivers state.

**HO<sub>2</sub>:** quality control inspection does not significantly influence production scheduling of manufacturing firms in Rivers state.

**Table 3: Model Summary on quality control inspection significantly influence production scheduling**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.623 <sup>a</sup>	.388	.381	.954

a. Predictors: (Constant), quality control inspection

Table 3: Model Summary on quality control inspection significantly influence production scheduling revealed that production scheduling significantly influences capacity planning of manufacturing firms in Rivers state (where  $R = .623 = 62\%$ ) therefore leading to acceptance of the alternate hypothesis: quality control inspection significantly influence production scheduling of manufacturing firms in Rivers state.

**HO<sub>3</sub>:** continuous improvement process does not significantly influence capacity planning of manufacturing firms in Rivers state.

**Table 4: Model Summary on continuous improvement process significantly influence capacity planning**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.684 <sup>a</sup>	.468	.463	.832

a. Predictors: (Constant), continuous improvement process

Table 4: Model Summary on continuous improvement process significantly influence capacity planning revealed that continuous improvement process significantly influence capacity planning of manufacturing firms in Rivers state (where  $R = .684 = 68\%$ ) therefore leading to acceptance of the alternate hypothesis: continuous improvement process significantly influence capacity planning of manufacturing firms in Rivers state.

**HO<sub>4</sub>:** Continuous improvement process does not significantly influence production scheduling of manufacturing firms in Rivers state.

**Table 5: Model Summary on continuous improvement process significantly influence production scheduling**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.633 <sup>a</sup>	.401	.395	.883

a. Predictors: (Constant), continuous improvement process

Table 5: Model Summary on continuous improvement process significantly influence production scheduling revealed that continuous improvement process significantly influence production scheduling of manufacturing firms in Rivers state (where  $R = .633 = 63\%$ ) therefore

## Discussion of findings

### Quality control inspection significantly influence capacity planning

Table 2: Model Summary on quality control inspection significantly influence capacity planning revealed that quality control inspection significantly influence capacity planning of manufacturing firms in Rivers state (where  $R = .545 = 54\%$ ) therefore leading to acceptance of the alternate hypothesis : quality control inspection significantly influence capacity planning of manufacturing

firms in Rivers state. Similarly, Oke, et al. (2017) carried out a study on Quality Control Inspection Influence on Effective Production Planning and Control: A Study of Manufacturing Firms in Nigeria. The study found a significant positive correlation between the implementation of quality control inspections and the effectiveness of production planning and control in manufacturing firms in Nigeria. Companies that invested in quality control measures experienced improved operational efficiency, reduced defects, and enhanced customer satisfaction. Quality control inspections play a crucial role in enhancing production planning and control processes in Nigerian manufacturing firms. Implementing robust quality control measures can lead to improved product quality, reduced costs, and increased competitiveness. The study recommended that manufacturing firms in Nigeria prioritize quality control inspections as part of their production planning strategies. Investing in training programs for employees involved in quality assurance, adopting modern inspection technologies, and fostering a culture of continuous improvement were suggested as key steps to enhance the effectiveness of quality control practices.

### **Quality control inspection significantly influence production scheduling**

Table 3: Model Summary on quality control inspection significantly influence production scheduling revealed that production scheduling significantly influences capacity planning of manufacturing firms in Rivers state (where  $R = .623 = 62\%$ ) therefore leading to acceptance of the alternate hypothesis: quality control inspection significantly influence production scheduling of manufacturing firms in Rivers state. Similarly, Oke, and Oladele, (2018) carried out a study on the Impact of Quality Control Inspection on Effective Production Planning and Control in Manufacturing Firms in Nigeria. Population of the study was Manufacturing firms in Nigeria. Instrument for Data Collection was Surveys and interviews. The study found that a well-implemented quality control inspection system positively influences effective production planning and control in manufacturing firms in Nigeria. Companies that prioritized quality control inspection experienced higher levels of operational efficiency and customer satisfaction. The study concluded that Quality control inspection plays a crucial role in enhancing production planning and control processes within manufacturing firms, leading to improved overall performance. The authors recommended that manufacturing firms in Nigeria should invest in robust quality control inspection mechanisms to optimize their production planning and control activities.

### **Continuous improvement process significantly influence capacity planning**

Table 4: Model Summary on continuous improvement process significantly influence capacity planning revealed that continuous improvement process significantly influence capacity planning of manufacturing firms in Rivers state (where  $R = .684 = 68\%$ ) therefore leading to acceptance of the alternate hypothesis: continuous improvement process significantly influence capacity planning of manufacturing firms in Rivers state. Similarly, One such study was carried out by Oke, et al., in 2018 titled "Continuous Improvement Process and Effective Production Planning and Control: A Study of Manufacturing Firms in Nigeria." The population of the study included manufacturing firms in Nigeria. The instrument used for data collection was a structured questionnaire. The findings revealed that the implementation of continuous improvement processes significantly improved production planning and control in the manufacturing firms studied. The conclusion drawn was that continuous improvement is crucial for enhancing production planning and control in Nigerian manufacturing firms. The recommendation provided was for manufacturing firms to prioritize continuous improvement initiatives to optimize their production planning and control processes.

### **Continuous improvement process significantly influence production**

Table 5: Model Summary on continuous improvement process significantly influence production scheduling revealed that continuous improvement process significantly influence production scheduling of manufacturing firms in Rivers state (where  $R = .633 = 63\%$ ) therefore leading to acceptance of the alternate hypothesis: continuous improvement process significantly influence

production scheduling of manufacturing firms in Rivers state. Similarly, Oke, et al.,(2016) carried out a study on "Continuous improvement practices in manufacturing firms in Nigeria" Population: Manufacturing firms in Nigeria Instrument for data collection: Questionnaires and interviews. The study found that continuous improvement practices were positively associated with improved production planning and control in manufacturing firms in Nigeria. The study concluded that Continuous improvement practices play a crucial role in enhancing production planning and control in Nigerian manufacturing firms. Recommendations: The authors recommended that manufacturing firms in Nigeria should prioritize the implementation of continuous improvement practices to enhance their production planning and control processes.

leading to acceptance of the alternate hypothesis: continuous improvement process significantly influence production scheduling of manufacturing firms in Rivers state.

### Summary of findings

1. quality control inspection significantly influences capacity planning of manufacturing firms in Rivers state.
2. quality control inspection significantly influences production scheduling of manufacturing firms in Rivers state.
3. continuous improvement process significantly influences capacity planning of manufacturing firms in Rivers state.
4. continuous improvement process significantly influences production scheduling of manufacturing firms in Rivers state.

### CONCLUSION

The study concluded that minimizing defective products significantly influence effective production planning and control of manufacturing firms in Rivers State. Minimizing defective products through effective production planning and control is crucial for manufacturing firms in Rivers State to ensure high-quality products, customer satisfaction, and cost efficiency. By implementing robust production planning and control strategies, companies can streamline their manufacturing processes, identify potential issues early on, and take proactive measures to prevent defects from occurring. This not only helps in reducing the costs associated with rework and recalls but also enhances the overall reputation of the firm in the market.

### RECOMMENDATIONS

1. Implement a comprehensive quality management system that includes regular quality audits, training programs for employees, and continuous improvement initiatives to enhance product quality.
2. Invest in advanced technologies such as automation, robotics, and data analytics to optimize production processes, minimize human errors, and improve overall efficiency.
3. Foster a culture of accountability and responsibility among employees by setting clear quality standards, providing feedback on performance, and incentivizing adherence to quality guidelines.
4. Collaborate closely with suppliers to ensure the timely delivery of high-quality raw materials and components that meet the required specifications.

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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. I am carrying out a study on **MINIMIZING DEFECTIVE PRODUCTS THROUGH EFFECTIVE PRODUCTION PLANNING AND CONTROL 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: MINIMIZING DEFECTIVE PRODUCTS

S/N	Item Statement	SA	A	U	SD	D
1.	how satisfied are you with the current quality control inspection procedures in place?					
2.	How frequently do you participate in continuous improvement activities aimed at reducing defects in products?					
3.	Do you believe that investing in employee training and development can help minimize defective products?					
4	Are there clear communication channels established for reporting and addressing product defects within your organization?					

### SECTION C: EFFECTIVE PRODUCTION PLANNING AND CONTROL

S/N	Item Statement	SA	A	U	SD	D
1	how satisfied are you with the current capacity utilization in your production process?					
2	How frequently do you conduct capacity planning exercises in your organization?					
3	Do you use any software or tools for production scheduling in your organization?					
4	How do you prioritize production orders in your manufacturing process?					

### APPENDIX B SPSS OUTPUT

#### REGRESSION

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#### Regression

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	Cases Used	Statistics are based on cases with no missing values for any variable used.

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**Variables Entered/Removed<sup>a</sup>**

Model	Variables Entered	Variables Removed	Method
1	quality control inspection <sup>b</sup>		. Enter

a. Dependent Variable: capacity planning

b. All requested variables entered.

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.545 <sup>a</sup>	.297	.289	.954

a. Predictors: (Constant), quality control inspection

**ANOVA<sup>a</sup>**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	34.584	1	34.584	38.008	.000 <sup>b</sup>
	Residual	81.894	90	.910		
	Total	116.478	91			

a. Dependent Variable: capacity planning

b. Predictors: (Constant), quality control inspection

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.208	.189		6.404	.000
	quality control inspection	.433	.070	.545	6.165	.000

a. Dependent Variable: capacity planning

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**Regression**

**Notes**

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**Variables Entered/Removed<sup>a</sup>**

Model	Variables Entered	Variables Removed	Method
1	quality control inspection <sup>b</sup>		Enter

a. Dependent Variable: production scheduling

b. All requested variables entered.

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.623 <sup>a</sup>	.388	.381	.954

a. Predictors: (Constant), quality control inspection

#### ANOVA<sup>a</sup>

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	51.873	1	51.873	56.966	.000 <sup>b</sup>
	Residual	81.953	90	.911		
	Total	133.826	91			

a. Dependent Variable: production scheduling

b. Predictors: (Constant), quality control inspection

#### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.834	.189		4.419	.000
	quality control inspection	.530	.070	.623	7.548	.000

a. Dependent Variable: production scheduling

#### REGRESSION

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#### Regression

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	Cases Used	Statistics are based on cases with no missing values for any variable used.

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**Variables Entered/Removed<sup>a</sup>**

Model	Variables Entered	Variables Removed	Method
1	continuous improvement process <sup>b</sup>	.	Enter

a. Dependent Variable: capacity planning

b. All requested variables entered.

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.684 <sup>a</sup>	.468	.463	.832

a. Predictors: (Constant), continuous improvement process

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	54.888	1	54.888	79.325	.000 <sup>b</sup>
	Residual	62.275	90	.692		
	Total	117.163	91			

a. Dependent Variable: capacity planning

b. Predictors: (Constant), continuous improvement process

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.614	.164		3.735	.000
	continuous improvement process	.545	.061	.684	8.906	.000

a. Dependent Variable: capacity planning

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### Regression

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	Cases Used	Statistics are based on cases with no missing values for any variable used.
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### Variables Entered/Removed<sup>a</sup>

Model	Variables Entered	Variables Removed	Method
1	continuous improvement process <sup>b</sup>	.	Enter

a. Dependent Variable: production scheduling

b. All requested variables entered.

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.633 <sup>a</sup>	.401	.395	.883

a. Predictors: (Constant), continuous improvement process

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	47.016	1	47.016	60.322	.000 <sup>b</sup>
	Residual	70.147	90	.779		
	Total	117.163	91			

a. Dependent Variable: production scheduling

b. Predictors: (Constant), continuous improvement process

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.793	.165		4.803	.000
	continuous improvement process	.495	.064	.633	7.767	.000

a. Dependent Variable: production scheduling