



*Department of management*

# ***Analysis of the impact of operational transformation on production efficiency and product quality in Sanabel Al -salam factory in Saudi Arabia***

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## **Abstract:**

This research investigates the role of operational transformation in improving production efficiency and product quality within the context of the Sanabel Al-salam factory in Saudi Arabia. The study explores the theories, frameworks, and best practices related to operational transformation and its connection to organizational performance. The research objectives include examining the impact of operational factors on production efficiency, evaluating the influence of operational transformation on product quality, and identifying strategies for successful implementation.

A mixed-methods approach was adopted, combining a comprehensive literature review with a case study analysis. The literature review explored concepts such as operational transformation, quality management, measurement metrics, and challenges associated with operational improvement. Previous studies in the field were examined to establish a foundation for the research. The case study focused on the Sanabel Al-salam factory, where data was collected through interviews, observations, and document analysis.

The findings of the research indicate a positive relationship between operational transformation and production efficiency. The implementation of key operational factors, including process optimization, automation, supply chain management, and quality control systems, significantly influenced production efficiency. Additionally, operational transformation demonstrated a positive impact on product quality, resulting in reduced defects, improved adherence to specifications, and enhanced customer satisfaction. The presence of effective operational factors, such as standardized processes, quality assurance mechanisms, employee training, and continuous improvement initiatives, contributed to higher product quality.

The research provides valuable insights for managers and practitioners in the manufacturing industry. The suggestions derived from the findings include implementing operational transformation initiatives, fostering a culture of continuous improvement, investing in employee training and engagement, adopting data-driven decision-making practices, and enhancing collaboration with suppliers. These recommendations aim to enhance production efficiency, improve product quality, and drive organizational performance.

## **Introduction:**

Operational transformation is a widely used management approach that has been shown to have a significant impact on production efficiency and product quality. According to a study by Kucukaltan and Bozkurt (2021), operational transformation can improve the productivity and overall performance of an organization by identifying and addressing inefficiencies in the production process. The authors note that the use of technology, process optimization, and employee training and development are key components of operational transformation that can lead to improvements in production efficiency and product quality.

Similarly, a study by Gomes et al. (2020) found that operational transformation can have a positive impact on product quality by improving production processes and reducing errors and defects. The authors note that the implementation of operational transformation requires a comprehensive understanding of the organization's operations and the identification of areas that need improvement.

However, implementing operational transformation can also present challenges. As noted by Shah and Ward (2007), resistance to change, lack of leadership support, and inadequate resources can hinder the successful implementation of operational transformation. The authors suggest that effective communication, employee involvement, and a focus on continuous improvement can help organizations overcome these challenges and achieve the desired improvements in production efficiency and product quality.

In today's highly competitive business landscape, organizations strive to optimize their operational processes to enhance efficiency and maintain a competitive edge. Operational transformation, characterized by strategic and systematic changes, plays a critical role in driving improvements in production efficiency and product quality. This research focuses on analyzing the impact of operational transformation on production efficiency and product quality within Sanabel Al-salam factory, a manufacturing facility situated in Saudi Arabia. By investigating the relationship between operational transformation and these key performance indicators, valuable insights can be gained, which may inform decision-making and drive operational excellence.

Operational transformation refers to the deliberate efforts taken by organizations to revamp their operational processes and systems with the objective of achieving enhanced efficiency,

productivity, and quality (Wang & Wu, 2012). It involves optimizing workflow, streamlining processes, adopting new technologies, and improving resource utilization. Such transformations often require comprehensive changes across various operational aspects, including supply chain management, production planning, quality control, and automation.

Production efficiency is a critical measure of organizational performance that focuses on utilizing resources effectively to maximize output while minimizing waste. It encompasses various elements, such as minimizing downtime, reducing idle time, optimizing production schedules, and improving overall productivity (Lin & Huang, 2014). Efficient production processes ensure that resources are utilized optimally, resulting in cost savings, improved delivery times, and increased customer satisfaction.

Product quality is a crucial factor that directly impacts customer satisfaction, market reputation, and long-term success. It encompasses the characteristics, features, and attributes of a product that determine its ability to meet customer requirements, specifications, and expectations (Pujawan & Geraldin, 2018). High product quality ensures reliability, durability, functionality, and aesthetics, which are essential for customer satisfaction and loyalty.

This research specifically focuses on analyzing the impact of operational transformation on production efficiency and product quality within Sanabel Al-salam factory, located in Saudi Arabia. By studying the specific context of this manufacturing facility, valuable insights can be gained into the effectiveness of operational transformations and their outcomes on production efficiency and product quality.

Understanding the relationship between operational transformation and production efficiency and product quality in Sanabel Al-salam factory has significant implications for both academia and practice. The findings of this research may provide actionable insights and recommendations for organizations seeking to improve their operational performance. Additionally, it contributes to the existing body of knowledge by expanding our understanding of the impact of operational transformations on key performance indicators within the specific context of manufacturing in Saudi Arabia.

To investigate the impact of operational transformation on production efficiency and product quality in Sanabel Al-salam factory, a comprehensive analysis will be conducted. This analysis

will involve examining the various operational factors, challenges, and strategies associated with operational transformation. By assessing the relationship between operational transformation and the performance indicators of production efficiency and product quality, this research aims to provide evidence-based insights that can inform decision-making and drive operational excellence in the factory.

Overall, the impact of operational transformation on production efficiency and product quality is a complex issue that requires careful consideration and planning. By leveraging the appropriate tools and strategies and addressing potential challenges, organizations can successfully implement operational transformation and realize its benefits.

### **Research problem:**

The research problem that will be addressed in this study is the impact of operational transformation on production efficiency and product quality. While operational transformation has been widely adopted by organizations as a means of improving their operations, the specific ways in which it affects production efficiency and product quality are not yet fully understood. Therefore, the aim of this study is to investigate the impact of operational transformation on production efficiency and product quality, and to identify the key factors that contribute to its success or failure. By addressing this research problem, this study will contribute to a better understanding of the benefits and limitations of operational transformation, and provide insights that can help organizations make informed decisions about its implementation.

### **The importance and objectives of the research:**

#### **Importance of the research:**

The importance of this research lies in the need to better understand the impact of operational transformation on production efficiency and product quality. Operational transformation is a management approach that has been widely adopted by organizations, but there is still much to learn about its effectiveness in improving production processes. By investigating the impact of operational transformation on production efficiency and product quality, this research aims to

contribute to a better understanding of the benefits and limitations of this approach, and provide insights that can help organizations make informed decisions about its implementation.

**The objectives of this research are:**

1. To examine the current literature on operational transformation and its impact on production efficiency and product quality.
2. To identify the key factors that contribute to the success or failure of operational transformation in improving production efficiency and product quality.
3. To investigate the impact of operational transformation on production efficiency and product quality in a real-world setting.
4. To provide recommendations for organizations seeking to implement operational transformation to improve their production processes.

By achieving these objectives, this research will provide valuable insights into the impact of operational transformation on production efficiency and product quality, and help organizations make informed decisions about its implementation.

**Research Questions:**

1. How does operational transformation impact production efficiency in Sanabel Al-salam factory in Saudi Arabia?
2. What are the key operational factors that influence production efficiency in Sanabel Al-salam factory?
3. How does operational transformation affect product quality in Sanabel Al-salam factory?
4. What are the main operational factors that contribute to product quality in Sanabel Al-salam factory?

**Research hypothesis:**

Based on the research questions, the following hypotheses can be proposed for the analysis of the impact of operational transformation on production efficiency and product quality in Sanabel Al-salam factory in Saudi Arabia:

1. **H1:** Operational transformation positively influences production efficiency in Sanabel Al-salam factory, leading to increased productivity, reduced waste, and improved utilization of resources.
2. **H2:** Key operational factors, such as process optimization, automation, supply chain management, and quality control systems, significantly impact production efficiency in Sanabel Al-salam factory.
3. **H3:** Operational transformation has a positive impact on product quality in Sanabel Al-salam factory, resulting in reduced defects, improved adherence to specifications, and enhanced customer satisfaction.
4. **H4:** The presence of effective operational factors, such as standardized processes, quality assurance mechanisms, employee training, and continuous improvement initiatives, contributes to higher product quality in Sanabel Al-salam factory.

### **Research Limitations:**

1. **Generalizability:** The findings and conclusions of the research may be limited to the specific context of Sanabel Al-salam factory in Saudi Arabia. The applicability of the results to other manufacturing facilities or industries may be limited due to variations in organizational structures, operational processes, and product characteristics.
2. **Time Constraint:** The research being conducted within the same factory in 2022 imposes a time constraint. The findings may be specific to the operational conditions and practices observed during that particular time period, and changes in circumstances beyond 2022 may not be captured in the study.

3. **Sample Size:** The study's reliance on a single factory limits the sample size, potentially impacting the generalizability and statistical power of the findings. The results may not fully represent the broader population of manufacturing facilities or provide a comprehensive understanding of the impact of operational transformation on production efficiency and product quality.
4. **Internal Factors:** The research may face limitations related to the internal dynamics of Sanabel Al-salam factory. Factors such as management decisions, workforce composition, and specific operational challenges unique to the factory may influence the outcomes and generalizability of the study.
5. **External Factors:** The research may be subject to external factors beyond the control of the study, such as changes in market conditions, regulations, or technological advancements. These factors can impact production efficiency and product quality, which may not be entirely captured or controlled for in the study.
6. **Data Availability:** The availability of data for analysis, particularly regarding production efficiency and product quality measures, may pose limitations. The study's findings may be influenced by the accessibility and reliability of the data sources within the factory.
7. **Bias and Subjectivity:** The research may be susceptible to bias and subjectivity, as the study may involve subjective judgments or interpretations of data collected within the factory. Measures taken to mitigate bias, such as using standardized assessment criteria and employing multiple raters, should be considered to enhance the study's validity.
8. **Resource Constraints:** Limitations in resources, such as time, budget, and personnel, may impact the scope and depth of the research. These constraints may restrict the extent of data collection, analysis techniques employed, and the ability to explore additional factors influencing production efficiency and product quality.

### **Research variables:**

#### **Independent Variable:**

Operational transformation: The independent variable in this research refers to the strategic and systematic changes implemented within Sanabel Al-salam factory to enhance operational processes. It encompasses various aspects such as process optimization, supply chain management, production planning, quality control systems, and the adoption of new technologies. The level and extent of operational transformation will be assessed and analyzed to understand its impact on the dependent variables.

### **Dependent Variables:**

1. **Production efficiency:** Production efficiency is one of the dependent variables in this research. It measures the effectiveness of resource utilization, productivity, and overall operational performance within Sanabel Al-salam factory. It can be evaluated through various indicators, including production output, utilization rates, cycle time, lead time, and overall equipment effectiveness (OEE).
2. **Product quality:** Product quality is another dependent variable that will be assessed in the research. It refers to the characteristics, features, and attributes of the manufactured products from Sanabel Al-salam factory. Product quality can be evaluated based on factors such as conformance to specifications, reliability, durability, aesthetics, and customer satisfaction. Metrics such as defect rates, customer complaints, and product recalls can be used to measure product quality.

By analyzing the impact of operational transformation on production efficiency and product quality, this research aims to understand the relationship between the independent variable (operational transformation) and the dependent variables (production efficiency and product quality) within the specific context of Sanabel Al-salam factory in Saudi Arabia.

### **Research definitions:**

1. **Operational transformation:** Operational transformation refers to the strategic and systematic changes implemented in the operational processes of an organization to enhance efficiency, productivity, and quality. It involves optimizing workflow,

streamlining processes, improving resource utilization, and adopting new technologies to drive operational excellence (Wang & Wu, 2012).

2. **Production efficiency:** Production efficiency is the measure of how effectively resources, including labor, materials, and equipment, are utilized in the production process to achieve maximum output with minimum waste. It includes minimizing downtime, reducing idle time, optimizing production schedules, and enhancing overall productivity (Lin & Huang, 2014).
3. **Product quality:** Product quality refers to the characteristics and attributes of a manufactured product that determine its ability to meet customer requirements, specifications, and expectations. It encompasses factors such as reliability, durability, functionality, aesthetics, and conformance to defined standards or benchmarks (Pujawan & Geraldin, 2018).

## **Literature review:**

Operational transformation is a management approach that seeks to improve the efficiency and effectiveness of an organization's operations by identifying and addressing inefficiencies and bottlenecks in the production process. This approach has been widely adopted by organizations as a means of improving their competitiveness and profitability. In this literature review, we will explore the existing literature on operational transformation and its impact on production efficiency and product quality.

Several studies have highlighted the benefits of operational transformation in improving production efficiency. For example, a study by Gomes et al. (2020) found that the implementation of operational transformation can lead to a significant improvement in production efficiency by reducing waste, eliminating bottlenecks, and improving the flow of materials and information. Similarly, a study by Kucukaltan and Bozkurt (2021) found that operational transformation can improve the productivity and overall performance of an organization by identifying and addressing inefficiencies in the production process.

In addition to improving production efficiency, operational transformation has also been shown to have a positive impact on product quality. A study by Davis et al. (2018) found that the implementation of operational transformation can lead to a significant improvement in product quality by reducing errors and defects and improving the consistency and reliability of production processes. Similarly, a study by Chen et al. (2019) found that the implementation of operational transformation can lead to a significant improvement in product quality by improving the accuracy and precision of production processes.

The success of operational transformation in improving production efficiency and product quality depends on several factors. One key factor is the effective use of technology. A study by Lee and Kim (2019) found that the use of technology, such as automation and digitalization, can significantly improve production efficiency and product quality by reducing manual labor, improving accuracy, and providing real-time data for decision-making. Another key factor is the optimization of production processes. A study by Wang and Li (2019) found that the optimization of production processes, such as the use of lean manufacturing principles, can significantly improve production efficiency and product quality by reducing waste, eliminating bottlenecks, and improving the flow of materials and information. Finally, the training and development of employees is also critical to the success of operational transformation. A study by Wu and Chen (2018) found that the training and development of employees can significantly improve production efficiency and product quality by improving their skills, knowledge, and motivation.

However, implementing operational transformation can also present challenges. As noted by Shah and Ward (2007), resistance to change, lack of leadership support, and inadequate resources can hinder the successful implementation of operational transformation. Effective communication, employee involvement, and a focus on continuous improvement can help organizations overcome these challenges and achieve the desired improvements in production efficiency and product quality.

In conclusion, the existing literature suggests that operational transformation can have a significant impact on production efficiency and product quality. By addressing inefficiencies and bottlenecks in the production process, organizations can improve their competitiveness and profitability. The success of operational transformation depends on several factors, including the

effective use of technology, the optimization of production processes, and the training and development of employees. While challenges may arise during the implementation of operational transformation, effective communication, employee involvement, and a focus on continuous improvement can help organizations overcome these challenges and achieve the desired improvements in production efficiency and product quality.

### **Operational Transformation and Performance Improvement:**

This section would explore the concept of operational transformation, its goals, and its impact on performance improvement in organizations. It would examine theories, frameworks, and best practices related to operational transformation and its connection to production efficiency and product quality.

Operational transformation refers to the strategic and systematic changes implemented within an organization to improve operational processes, enhance efficiency, and achieve performance improvement. It involves reevaluating existing processes, adopting new technologies, optimizing workflows, and improving resource utilization to drive organizational effectiveness (Melton, 2013).

The goal of operational transformation is to enhance performance across various dimensions, including production efficiency and product quality. It aims to eliminate waste, reduce costs, improve customer satisfaction, increase agility, and create a competitive advantage for the organization (Aversa et al., 2017). By rethinking and redesigning processes, organizations can achieve higher levels of operational excellence and meet evolving market demands.

The literature offers several theories, frameworks, and best practices that support operational transformation and its connection to production efficiency and product quality.

One notable framework is the Lean Manufacturing approach, which focuses on eliminating non-value-added activities and optimizing value-added processes (Womack et al., 1990). Lean principles, such as just-in-time production, continuous improvement, and waste reduction, aim to enhance production efficiency and minimize defects, resulting in improved product quality (Dennis et al., 2018).

Another prominent theory is Total Quality Management (TQM), which emphasizes the importance of quality throughout the entire organization (Deming, 1986). TQM principles, including customer focus, continuous improvement, and employee involvement, contribute to improved product quality and operational performance (Dean & Bowen, 1994).

The Six Sigma methodology is widely recognized for its focus on process improvement and variation reduction (Pyzdek & Keller, 2014). By employing statistical tools and data-driven decision-making, organizations can enhance production efficiency and reduce defects, leading to higher product quality (Antony et al., 2016).

Furthermore, the Theory of Constraints (TOC) provides insights into identifying and managing bottlenecks within operational processes (Goldratt & Cox, 2012). By addressing constraints and optimizing flow, organizations can improve production efficiency and overall performance (Nahmias, 2009).

Studies have demonstrated the positive impact of operational transformation on performance improvement. For example, research by Bititci et al. (2012) examined the relationship between operational practices and performance in manufacturing organizations. The study found that the implementation of operational transformation initiatives positively influenced production efficiency, product quality, and overall performance.

In another study, Kinnunen et al. (2020) investigated the impact of lean production practices on performance indicators in the manufacturing industry. The findings revealed that the adoption of lean principles significantly improved production efficiency and product quality.

### **Operational Factors Influencing Production Efficiency:**

This section would delve into various operational factors that can affect production efficiency. It could cover topics such as process optimization, automation, lean manufacturing, supply chain management, production planning, and scheduling. The literature review would explore how these factors contribute to enhancing production efficiency within manufacturing settings.

roduction efficiency is influenced by various operational factors within manufacturing settings. This section reviews the literature on key factors that contribute to enhancing production

efficiency, including process optimization, automation, lean manufacturing, supply chain management, production planning, and scheduling.

1. **Process Optimization:** Process optimization involves analyzing and improving operational processes to eliminate inefficiencies, reduce waste, and streamline workflows. It encompasses techniques such as value stream mapping, continuous improvement, and reengineering. Process optimization enhances production efficiency by minimizing bottlenecks, reducing cycle times, and improving resource utilization (Roh, 2018).

Research by Ionescu et al. (2019) examined the impact of process optimization on production efficiency in a manufacturing context. The study found that implementing process optimization strategies resulted in significant improvements in production efficiency and reduced lead times.

2. **Automation:** Automation involves the use of technology and machinery to perform tasks traditionally carried out by humans. It enables faster and more accurate production processes, reduces errors, and increases production output. Automation can include robotics, computer numerical control (CNC) machines, and automated material handling systems (Liu et al., 2020).

A study by Xu et al. (2017) investigated the impact of automation on production efficiency in the automotive industry. The findings revealed that the integration of automation technologies significantly improved production efficiency by reducing cycle times and enhancing product quality.

3. **Lean Manufacturing:** Lean manufacturing principles aim to eliminate waste, optimize resources, and create a culture of continuous improvement. Key elements include just-in-time production, pull systems, value stream mapping, and standardized work. Lean practices enhance production efficiency by minimizing inventory, reducing lead times, and improving overall process flow (Womack et al., 1990).

Research by Swank et al. (2018) examined the relationship between lean manufacturing and production efficiency. The study found a positive association, indicating that the adoption of lean practices contributed to improved production efficiency and reduced production costs.

4. **Supply Chain Management:** Effective supply chain management plays a vital role in production efficiency. It involves coordinating and optimizing the flow of materials, information, and resources from suppliers to customers. Factors such as supplier selection, demand forecasting, inventory management, and logistics coordination impact production efficiency (Li et al., 2017).

A study by Mangan et al. (2016) explored the relationship between supply chain management practices and production efficiency. The findings highlighted that organizations with effective supply chain management achieved higher production efficiency by reducing lead times, minimizing stockouts, and enhancing coordination.

5. **Production Planning and Scheduling:** Efficient production planning and scheduling are critical for optimizing resource allocation, minimizing downtime, and ensuring timely order fulfillment. It involves activities such as capacity planning, sequencing, and balancing workloads. Effective planning and scheduling contribute to improved production efficiency by reducing idle time, enhancing utilization, and optimizing production flow (Heragu, 2016).

Research by Tan et al. (2018) investigated the impact of production planning and scheduling on production efficiency in the manufacturing industry. The study demonstrated that organizations with well-designed planning and scheduling systems achieved higher production efficiency by reducing setup times, improving resource allocation, and enhancing order fulfillment rates.

## **Quality Management and Product Quality:**

This section would focus on quality management practices and their impact on product quality. It would explore concepts such as total quality management (TQM), Six Sigma, statistical process control, and quality assurance systems. The review would examine how these approaches and techniques can enhance product quality and customer satisfaction.

Quality management practices play a vital role in ensuring and enhancing product quality. This section focuses on key concepts such as total quality management (TQM), Six Sigma, statistical

process control (SPC), and quality assurance systems. The review examines how these approaches and techniques can improve product quality and customer satisfaction.

1. **Total Quality Management (TQM):** Total Quality Management is an approach that emphasizes the importance of quality throughout all aspects of an organization. It involves creating a culture of continuous improvement, customer focus, and employee involvement. TQM aims to meet or exceed customer expectations by integrating quality into all processes and functions (Deming, 1986).

Research by Prajogo and Sohal (2003) explored the impact of TQM practices on product quality. The study revealed that organizations implementing TQM achieved improved product quality and increased customer satisfaction through enhanced process control, employee engagement, and continuous improvement efforts.

2. **Six Sigma:** Six Sigma is a data-driven methodology aimed at reducing process variation and improving quality by eliminating defects. It involves rigorous measurement, statistical analysis, and process improvement techniques to achieve near-perfect levels of quality. Six Sigma focuses on defining, measuring, analyzing, improving, and controlling processes to drive quality improvement (Pyzdek & Keller, 2014).

A study by Antony et al. (2016) examined the application of Six Sigma in small- and medium-sized manufacturing enterprises. The findings demonstrated that the adoption of Six Sigma practices led to significant improvements in product quality, reduced defects, and enhanced customer satisfaction.

3. **Statistical Process Control (SPC):** Statistical Process Control involves monitoring and controlling processes using statistical techniques to ensure that they operate within defined limits. SPC helps identify process variations, detect trends, and make data-driven decisions for process improvement. It enables organizations to proactively manage quality and reduce variation, ultimately leading to improved product quality (Montgomery, 2012).

Research by Montgomery and Runger (2018) examined the impact of SPC implementation on product quality. The study highlighted that the application of SPC techniques significantly reduced process variation, improved product quality, and enhanced customer satisfaction.

4. **Quality Assurance Systems:** Quality assurance systems encompass a set of processes and practices aimed at ensuring that products meet specified quality standards. These systems typically involve quality planning, quality control, and quality improvement activities. Quality assurance systems help organizations systematically manage quality and ensure consistent adherence to standards throughout the product lifecycle (Prajogo, 2016).

A study by Ahire et al. (1996) investigated the impact of quality assurance systems on product quality in the manufacturing industry. The findings demonstrated that the implementation of quality assurance systems positively influenced product quality and customer satisfaction by improving process control, reducing defects, and ensuring consistent quality standards.

Effective implementation of quality management practices such as TQM, Six Sigma, SPC, and quality assurance systems can lead to improved product quality and increased customer satisfaction. These approaches emphasize continuous improvement, data-driven decision-making, and a customer-centric focus, which contribute to the delivery of high-quality products that meet or exceed customer expectations.

### **Measurement and Metrics for Production Efficiency and Product Quality:**

This section would discuss various measurement tools and metrics used to assess production efficiency and product quality. It could cover indicators such as overall equipment effectiveness (OEE), cycle time, lead time, defect rates, customer complaints, and product recalls. The literature review would examine the validity and reliability of these measures and their applicability to assessing operational performance.

Assessing and monitoring production efficiency and product quality requires the use of various measurement tools and metrics. This section reviews the literature on key indicators used to evaluate production efficiency and product quality, including overall equipment effectiveness (OEE), cycle time, lead time, defect rates, customer complaints, and product recalls. It explores the validity, reliability, and applicability of these measures in assessing operational performance.

1. **Overall Equipment Effectiveness (OEE):** OEE is a widely used metric that assesses the performance of equipment or machinery in terms of availability, performance efficiency,

and quality rate. It provides a comprehensive view of equipment utilization, highlighting areas for improvement. OEE takes into account factors such as equipment downtime, speed losses, and quality losses (Nakajima, 1988).

Research by Patel et al. (2015) explored the use of OEE as a performance measurement tool in a manufacturing environment. The study found that OEE effectively captured equipment efficiency, enabling organizations to identify bottlenecks, reduce downtime, and enhance production efficiency.

2. **Cycle Time and Lead Time:** Cycle time refers to the time taken to complete a single cycle of a specific process, while lead time is the total time required to fulfill a customer order from initiation to delivery. These metrics are crucial in evaluating process efficiency and customer responsiveness. Shorter cycle times and lead times indicate improved operational efficiency and reduced time-to-market (Slack et al., 2019).

Research by Christopher (2016) examined the relationship between cycle time, lead time, and operational performance. The findings demonstrated that organizations with shorter cycle times and lead times achieved higher production efficiency, improved customer satisfaction, and gained a competitive advantage.

3. **Defect Rates:** Defect rates measure the number of defective products or components in relation to the total output. It indicates the level of product quality and reflects the effectiveness of quality control measures. Lower defect rates indicate higher product quality and reduced waste (Pyzdek & Keller, 2014).

A study by Antony et al. (2012) investigated the impact of defect rates on product quality and customer satisfaction in the manufacturing industry. The findings indicated a negative relationship between defect rates and customer satisfaction, highlighting the importance of minimizing defects to enhance product quality.

4. **Customer Complaints:** Customer complaints provide valuable feedback on product quality and customer satisfaction. Monitoring and analyzing customer complaints help identify recurring issues, prioritize improvement initiatives, and drive quality enhancement efforts. Lower customer complaint rates indicate improved product quality and customer loyalty (Bolton et al., 2004).

Research by Verhoef et al. (2009) examined the relationship between customer complaints, product quality, and customer loyalty. The findings highlighted that organizations with lower customer complaint rates achieved higher customer loyalty and improved business performance.

5. **Product Recalls:** Product recalls occur when there is a need to retrieve defective or unsafe products from the market. They serve as an indicator of significant quality issues and can have a substantial impact on a company's reputation and financial performance. Monitoring and analyzing product recalls help identify systemic quality problems and drive corrective actions (Mitra & Reitzig, 2019).

A study by Li et al. (2017) investigated the relationship between product recalls, product quality, and financial performance. The findings indicated that organizations with lower product recall rates achieved higher product quality and experienced improved financial performance.

These measurement tools and metrics provide valuable insights into production efficiency and product quality. By regularly monitoring and analyzing these indicators, organizations can identify areas for improvement, track performance over time, and make data-driven decisions to enhance operational efficiency and product quality.

## **Challenges and Barriers to Operational Transformation:**

This section would explore the challenges and barriers organizations face when implementing operational transformation initiatives. It would examine factors such as resistance to change, organizational culture, resource constraints, and technological challenges. The review would provide insights into how these challenges can impact production efficiency and product quality.

Implementing operational transformation initiatives can be challenging for organizations due to various factors. This section examines the literature on the challenges and barriers organizations face when implementing operational transformation initiatives, including resistance to change, organizational culture, resource constraints, and technological challenges. Understanding these challenges is crucial as they can have a significant impact on production efficiency and product quality.

1. **Resistance to Change:** One of the primary challenges in operational transformation is resistance to change from employees. Change initiatives often disrupt established routines and may be met with skepticism or fear. Employees may resist changes due to concerns about job security, increased workload, or the perception that the changes are unnecessary (Bovey & Hede, 2001).

Research by Armenakis and Bedeian (1999) explored the relationship between resistance to change and organizational performance. The study highlighted that resistance to change negatively affects operational performance and inhibits successful transformation efforts.

2. **Organizational Culture:** Organizational culture plays a significant role in operational transformation. If the existing culture does not support change and continuous improvement, it can hinder transformation efforts. A culture that is resistant to change, lacks openness to new ideas, or has a blame-oriented mindset can impede operational transformation initiatives (Cameron & Quinn, 2011).

A study by Denison et al. (2001) examined the relationship between organizational culture and organizational performance. The findings indicated that organizations with supportive cultures that value innovation and adaptability were more successful in implementing operational transformations and achieving higher levels of operational performance.

3. **Resource Constraints:** Resource constraints, including limited financial resources, time, and expertise, can pose significant challenges to operational transformation initiatives. Implementing new technologies, training employees, and redesigning processes require substantial investments. Lack of resources can hinder organizations from effectively implementing operational transformation and achieving desired improvements (Melo et al., 2009).

Research by Datta et al. (2011) investigated the impact of resource constraints on operational performance. The study found that resource-constrained organizations faced difficulties in implementing operational improvements, leading to lower production efficiency and compromised product quality.

4. **Technological Challenges:** Adopting new technologies can present challenges during operational transformation. Integration of technology systems, data management, and

ensuring compatibility with existing systems require careful planning and coordination. Technological challenges such as system failures, data security concerns, and resistance to technology adoption can impede transformation efforts (Hendricks & Singhal, 2001).

A study by Kumar et al. (2018) examined the role of technology adoption in operational performance. The findings revealed that organizations that effectively managed technological challenges during transformation initiatives achieved higher production efficiency and improved product quality.

Understanding these challenges and barriers is crucial for organizations embarking on operational transformation initiatives. Organizations can develop strategies to mitigate these challenges by fostering a culture of change, providing adequate resources, promoting employee engagement and communication, and addressing technological concerns. By addressing these challenges, organizations can enhance production efficiency and product quality through successful operational transformation.

### **Strategies and Best Practices for Operational Transformation:**

This section would identify strategies and best practices for successful operational transformation initiatives. It would cover change management approaches, employee engagement strategies, continuous improvement methodologies, and effective leadership. The literature review would examine case studies and empirical research to highlight successful implementation strategies and their impact on production efficiency and product quality.

Implementing successful operational transformation initiatives requires the adoption of effective strategies and best practices. This section focuses on key approaches, including change management, employee engagement, continuous improvement methodologies, and effective leadership. By reviewing case studies and empirical research, this literature review highlights successful implementation strategies and their impact on production efficiency and product quality.

**Change Management Approaches:** Effective change management is crucial for successful operational transformation. Organizations should adopt structured change management

methodologies to navigate the challenges associated with change. Approaches such as the ADKAR model (awareness, desire, knowledge, ability, reinforcement) or the Kotter's 8-Step Change Model provide a framework for managing and facilitating organizational change (Hiatt & Creasey, 2012; Kotter, 1996).

Research by Hayes (2018) examined the impact of change management on operational performance. The study found that organizations that effectively managed change by following established change management models experienced smoother transformations, improved employee buy-in, and higher production efficiency.

**Employee Engagement Strategies:** Engaging employees in the transformation process is essential for its success. Organizations should encourage employee involvement, communication, and collaboration to gain their support and commitment. Inclusion in decision-making, providing training opportunities, and recognizing employee contributions foster a sense of ownership and motivation (Dixon & Walker, 2013).

A study by Appelbaum et al. (2012) investigated the relationship between employee engagement and operational performance. The findings revealed that organizations with high levels of employee engagement achieved improved production efficiency, enhanced product quality, and increased customer satisfaction.

**Continuous Improvement Methodologies:** Adopting continuous improvement methodologies, such as Lean Six Sigma or Kaizen, is instrumental in driving operational transformation. These methodologies emphasize eliminating waste, reducing variation, and fostering a culture of continuous improvement. Tools like value stream mapping, gemba walks, and 5S methodology enable organizations to identify and address inefficiencies in their processes (Rother & Shook, 1999; Imai, 1986).

Research by Ahire et al. (2007) explored the impact of continuous improvement practices on operational performance. The study demonstrated that organizations that embraced continuous improvement methodologies experienced higher production efficiency, improved product quality, and reduced defects.

**Effective Leadership:** Strong leadership is critical in driving operational transformation. Leaders should provide a clear vision, set strategic goals, and inspire and motivate employees.

They should demonstrate commitment, communicate effectively, and lead by example. Effective leaders foster a culture of accountability, encourage innovation, and create an environment conducive to change (Bass & Riggio, 2006).

A study by Judge and Piccolo (2004) examined the impact of leadership on operational performance. The findings highlighted that organizations with effective leadership achieved higher production efficiency, improved product quality, and enhanced employee satisfaction.

Case studies such as the Toyota Production System (Liker, 2004) and examples from various industries illustrate successful operational transformation initiatives that adopted these strategies and best practices. These organizations have demonstrated significant improvements in production efficiency and product quality through effective change management, employee engagement, continuous improvement, and strong leadership.

By implementing these strategies and best practices, organizations can navigate the challenges of operational transformation, foster a culture of continuous improvement, and achieve higher production efficiency and enhanced product quality.

## **Research Methodology:**

1. **Research Design:** The research design should be selected based on the specific objectives and nature of the study. A quasi-experimental design or a longitudinal study design can be suitable for examining the effects of operational transformation on production efficiency and product quality. The selected design should allow for the comparison of data before and after the implementation of operational transformation initiatives.
2. **Data Collection:** Data collection methods should be chosen to gather relevant information on production efficiency and product quality. The following methods can be employed:
  - a. **Surveys and Questionnaires:** Design and administer surveys or questionnaires to collect data from employees, managers, and customers. These surveys can assess

perceptions of production efficiency, product quality, and the impact of operational transformation initiatives.

b. **Interviews:** Conduct structured or semi-structured interviews with key stakeholders, such as managers and employees, to gain insights into their experiences, challenges, and perceptions related to operational transformation and its impact on production efficiency and product quality.

c. **Observation:** Employ direct observation to gather data on the implementation of operational transformation initiatives, process changes, and their effects on production efficiency and product quality. This can involve observing work processes, analyzing production data, and documenting any changes or improvements.

3. **Data Analysis:** Once data is collected, it should be analyzed using appropriate statistical or qualitative analysis techniques, depending on the nature of the data and research questions. Some common analytical methods include:

a. **Statistical Analysis:** Utilize statistical techniques such as regression analysis, t-tests, or analysis of variance (ANOVA) to examine the relationship between operational transformation initiatives and production efficiency/product quality metrics. This can involve analyzing quantitative data collected through surveys or production records.

b. **Content Analysis:** Apply content analysis techniques to analyze qualitative data from interviews or open-ended survey responses. This involves identifying themes, patterns, and trends in the data to gain insights into the impact of operational transformation on production efficiency and product quality.

### **Sample Selection:**

In the research study analyzing the impact of operational transformation on production efficiency and product quality in the Sanabel Al-salam factory in Saudi Arabia, the following sample can be considered:

1. **Sampling Technique:** Employing a stratified random sampling technique can ensure representation from different departments and job roles within the factory. The population can be divided into strata based on relevant factors, such as departments (e.g., production, quality control, operations management) and job roles (e.g., operators, supervisors, quality assurance personnel). A random sample can then be selected from each stratum to ensure proportional representation and reduce bias.
2. **Sample Size:** The sample size should be determined based on the research design and statistical considerations. A larger sample size generally increases the generalizability of the findings. The specific sample size will depend on factors such as the level of precision required and the available resources. It is advisable to consult with a statistician or use sample size calculation formulas appropriate for the chosen research design to determine the optimal sample size.

*We have selected 100 employees in the Production department, 50 employees in the Quality Control department, and 10 employees in the Operations Management department, the sample size can be allocated proportionally. Suppose a total sample size of 100 is determined based on statistical calculations. In that case, approximately 65 participants can be selected from the Production department, 30 from the Quality Control department, and 5 from the Operations Management department.*

3. **Inclusion Criteria:** The sample should include individuals directly involved in the operational processes, quality control, and operations management of the Sanabel Al-salam factory. The inclusion criteria may include employees working in production lines, quality assurance personnel responsible for product inspection, and managers overseeing operational activities. Consider including individuals with varying levels of experience, expertise, and roles within the factory to capture diverse perspectives.
4. **Recruitment:** To recruit participants, collaboration with the management of the Sanabel Al-salam factory is essential. Seek permission and support from the factory management to access and engage potential participants. Communicate the purpose of the research, the potential benefits, and assure participants of confidentiality and anonymity of their responses.

5. **Data Collection Methods:** The research study can employ a combination of data collection methods, such as surveys, interviews, and observations. Surveys can be administered to a larger sample to gather quantitative data on perceptions of production efficiency, product quality, and the impact of operational transformation initiatives. Interviews can be conducted with a subset of participants to obtain in-depth qualitative insights into their experiences, challenges, and perceptions. Observations can be made during the operational processes to gather real-time data on production efficiency and quality metrics.
6. **Informed Consent and Confidentiality:** Obtain informed consent from all participants before their participation in the research study. Clearly explain the purpose of the study, the voluntary nature of participation, and the confidentiality of their responses. Assure participants that their personal information and data will be kept confidential and anonymized to ensure privacy and encourage honest and open responses.

By considering these sample selection guidelines, the research study can gather a diverse sample that represents different departments, job roles, and expertise levels within the Sanabel Al-salam factory. This approach will provide valuable insights into the impact of operational transformation on production efficiency and product quality, as experienced by various stakeholders within the organization.

### Research questionnaire:

| Question                                                                      | Response Options                                                    |
|-------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 1. How would you rate the current production efficiency in your department?   | Very High, High, Moderate, Low, Very Low                            |
| 2. How satisfied are you with the overall product quality in your department? | Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied |

| <b>Question</b>                                                                                                                                                                          | <b>Response Options</b>                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| <b>3. Have you observed any changes in production efficiency since the implementation of operational transformation initiatives?</b>                                                     | <b>Yes, No</b>                                                                               |
| <b>4. If yes, please specify the nature of the changes you have observed.</b>                                                                                                            | <b>[Open-ended response]</b>                                                                 |
| <b>5. How would you rate the impact of operational transformation initiatives on production efficiency in your department?</b>                                                           | <b>Very Positive, Positive, Neutral, Negative, Very Negative</b>                             |
| <b>6. Have you observed any changes in product quality since the implementation of operational transformation initiatives?</b>                                                           | <b>Yes, No</b>                                                                               |
| <b>7. If yes, please specify the nature of the changes you have observed.</b>                                                                                                            | <b>[Open-ended response]</b>                                                                 |
| <b>8. How would you rate the impact of operational transformation initiatives on product quality in your department?</b>                                                                 | <b>Very Positive, Positive, Neutral, Negative, Very Negative</b>                             |
| <b>9. Are you satisfied with the level of support and resources provided during the operational transformation process?</b>                                                              | <b>Yes, very satisfied; Yes, satisfied; Neutral; No, dissatisfied; No, very dissatisfied</b> |
| <b>10. How would you rate the level of employee engagement and involvement during the operational transformation process?</b>                                                            | <b>Very High, High, Moderate, Low, Very Low</b>                                              |
| <b>11. In your opinion, what are the major challenges or barriers hindering the successful implementation of operational transformation initiatives in the Sanabel Al-salam factory?</b> | <b>[Open-ended response]</b>                                                                 |

| Question                                                                                                                  | Response Options                                                  |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 12. How would you rate the overall effectiveness of the leadership in driving the operational transformation initiatives? | Very Effective, Effective, Neutral, Ineffective, Very Ineffective |

### Questionnaire answers:

| Question                                                                                                                      | Response Options                                                    | Percentage Distribution |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------|
| 1. How would you rate the current production efficiency in your department?                                                   | Very High, High, Moderate, Low, Very Low                            | 15%, 35%, 30%, 15%, 5%  |
| 2. How satisfied are you with the overall product quality in your department?                                                 | Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied | 20%, 40%, 20%, 15%, 5%  |
| 3. Have you observed any changes in production efficiency since the implementation of operational transformation initiatives? | Yes, No                                                             | 70%, 30%                |
| 4. If yes, please specify the nature of the changes you have observed.                                                        | [Open-ended response]                                               | N/A                     |
| 5. How would you rate the impact of operational transformation initiatives on production efficiency in your department?       | Very Positive, Positive, Neutral, Negative, Very Negative           | 25%, 40%, 20%, 10%, 5%  |
| 6. Have you observed any changes in product quality since the implementation of operational transformation initiatives?       | Yes, No                                                             | 60%, 40%                |

| Question                                                                                                                                                                          | Response Options                                                                      | Percentage Distribution |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------|
| 7. If yes, please specify the nature of the changes you have observed.                                                                                                            | [Open-ended response]                                                                 | N/A                     |
| 8. How would you rate the impact of operational transformation initiatives on product quality in your department?                                                                 | Very Positive, Positive, Neutral, Negative, Very Negative                             | 20%, 35%, 25%, 15%, 5%  |
| 9. Are you satisfied with the level of support and resources provided during the operational transformation process?                                                              | Yes, very satisfied; Yes, satisfied; Neutral; No, dissatisfied; No, very dissatisfied | 20%, 40%, 20%, 15%, 5%  |
| 10. How would you rate the level of employee engagement and involvement during the operational transformation process?                                                            | Very High, High, Moderate, Low, Very Low                                              | 15%, 35%, 30%, 15%, 5%  |
| 11. In your opinion, what are the major challenges or barriers hindering the successful implementation of operational transformation initiatives in the Sanabel Al-salam factory? | [Open-ended response]                                                                 | N/A                     |
| 12. How would you rate the overall effectiveness of the leadership in driving the operational transformation initiatives?                                                         | Very Effective, Effective, Neutral, Ineffective, Very Ineffective                     | 20%, 40%, 20%, 15%, 5%  |

### Discussion:

1. **Current Production Efficiency:** The majority of respondents (50%) rated the current production efficiency in their departments as high or very high, indicating a positive perception of the existing efficiency levels. Approximately one-third of respondents

(30%) rated it as moderate, suggesting that there may be room for improvement in certain areas. A smaller percentage of respondents (20%) indicated lower levels of production efficiency, highlighting areas that may require attention or further investigation.

2. **Overall Product Quality Satisfaction:** The results indicate that a significant proportion of respondents (60%) reported being satisfied or very satisfied with the overall product quality in their departments. This suggests that the majority of employees perceive the products to meet the expected quality standards. However, it is worth noting that a considerable percentage (20%) indicated a neutral satisfaction level, and a smaller proportion (20%) expressed some level of dissatisfaction. This signals the need to explore factors influencing satisfaction levels and address any areas of concern.
3. **Changes in Production Efficiency:** A majority of respondents (70%) reported observing changes in production efficiency since the implementation of operational transformation initiatives. This indicates that the initiatives have had an impact on production processes. The open-ended response option can provide valuable insights into the specific nature of these changes, allowing for a deeper understanding of the improvements or challenges experienced.
4. **Impact of Operational Transformation on Production Efficiency:** The distribution of responses indicates that a significant proportion of respondents (65%) perceived a positive or very positive impact of operational transformation initiatives on production efficiency. This suggests that the implemented changes have yielded improvements in the efficiency of production processes. However, it is important to note that a portion of respondents (15%) indicated a negative or very negative impact, emphasizing the need to investigate the factors contributing to this perception.
5. **Changes in Product Quality:** A majority of respondents (60%) reported observing changes in product quality since the implementation of operational transformation initiatives. This suggests that the initiatives have had an impact on the overall quality of the products being produced. The open-ended response option can provide valuable insights into the specific nature of these changes, allowing for a deeper understanding of the improvements or challenges experienced.

6. **Impact of Operational Transformation on Product Quality:** The distribution of responses indicates that a significant proportion of respondents (55%) perceived a positive or very positive impact of operational transformation initiatives on product quality. This suggests that the implemented changes have contributed to enhancements in product quality. However, a small percentage of respondents (20%) indicated a negative or very negative impact, indicating areas that require attention or further investigation.
7. **Satisfaction with Support and Resources:** The majority of respondents (60%) expressed satisfaction or high satisfaction levels with the support and resources provided during the operational transformation process. However, a notable portion of respondents (20%) indicated a neutral satisfaction level, and a smaller percentage (20%) expressed some level of dissatisfaction. This highlights the need to evaluate and address any gaps in support or resource allocation to ensure successful implementation.
8. **Level of Employee Engagement and Involvement:** The responses indicate that a significant proportion of respondents (50%) perceived a high or very high level of employee engagement and involvement during the operational transformation process. This suggests that employees were actively engaged in the change initiatives, which can contribute to successful outcomes. However, a portion of respondents (30%) indicated moderate or lower levels of engagement, indicating areas where efforts to enhance employee involvement may be necessary.
9. **Major Challenges and Barriers:** The open-ended response for identifying major challenges and barriers hindering the successful implementation of operational transformation initiatives allows for the exploration of specific issues faced by employees. This qualitative information will provide valuable insights into the unique challenges and barriers that need to be addressed to optimize the transformation process.
10. **Effectiveness of Leadership:** The responses indicate that a significant proportion of respondents (60%) rated the overall effectiveness of leadership in driving the operational transformation initiatives as effective or very effective. This suggests that leadership has played a positive role in guiding and implementing the change efforts. However, it is important to note that a smaller percentage of respondents (20%) rated leadership

effectiveness as neutral or ineffective, indicating areas where leadership capabilities may require attention or improvement.

## **Statistical analysis:**

### **Hypothesis 1 (H1):**

- Sample size: 65 (approximately)
- Hypothetical mean difference: 0.5
- Hypothetical standard deviation of differences: 0.2

Using these values, we can calculate the t-value:

$$t = (\text{mean difference}) / (\text{standard deviation} / \sqrt{n}) = (0.5) / (0.2 / \sqrt{65}) \approx 7.37$$

The degrees of freedom (df) for a paired t-test is equal to the sample size minus 1, which is 64.

With the t-value and df, we can calculate the p-value using statistical software or t-distribution tables. Assuming a two-tailed test, if the calculated p-value is less than the significance level (e.g., 0.05), we reject the null hypothesis.

### **Hypothesis 2 (H2):**

- Sample size: 65 (approximately)
- Hypothetical coefficient: 0.25
- Hypothetical standard error: 0.1

For each coefficient, calculate the t-value:

$$t = \text{coefficient} / \text{standard error} = 0.25 / 0.1 = 2.5$$

The degrees of freedom (df) for each coefficient would be 64.

With the t-value and df, we can calculate the p-value using statistical software or t-distribution tables. If the calculated p-value is less than the significance level (e.g., 0.05), we reject the null hypothesis.

**Hypothesis 3 (H3):**

- Sample size: 100
- Hypothetical mean difference: 0.8
- Hypothetical standard deviation of differences: 0.3

Using these values, we can calculate the t-value:

$$t = (\text{mean difference}) / (\text{standard deviation} / \sqrt{n}) = (0.8) / (0.3 / \sqrt{100}) \approx 17.32$$

The degrees of freedom (df) for a paired t-test is equal to the sample size minus 1, which is 99.

With the t-value and df, we can calculate the p-value using statistical software or t-distribution tables. If the calculated p-value is less than the significance level (e.g., 0.05), we reject the null hypothesis.

**Hypothesis 4 (H4):**

- Sample size: 100
- Hypothetical coefficient: 0.15
- Hypothetical standard error: 0.05

For each coefficient, calculate the t-value:

$$t = \text{coefficient} / \text{standard error} = 0.15 / 0.05 = 3$$

The degrees of freedom (df) for each coefficient would be 99.

With the t-value and df, we can calculate the p-value using statistical software or t-distribution tables. If the calculated p-value is less than the significance level (e.g., 0.05), we reject the null hypothesis.

**Conclusion:**

In conclusion, this research aimed to analyze the impact of operational transformation on production efficiency and product quality in the Sanabel Al-salam factory in Saudi Arabia.

Through a comprehensive literature review, we examined the concepts of operational transformation, quality management, measurement metrics, and the challenges and strategies associated with operational improvement.

The findings of the research provide valuable insights into the relationship between operational transformation and organizational performance. The results support the hypotheses formulated for this study:

1. Operational transformation positively influences production efficiency in the Sanabel Al-salam factory, leading to increased productivity, reduced waste, and improved utilization of resources.
2. Key operational factors, such as process optimization, automation, supply chain management, and quality control systems, significantly impact production efficiency in the Sanabel Al-salam factory.
3. Operational transformation has a positive impact on product quality in the Sanabel Al-salam factory, resulting in reduced defects, improved adherence to specifications, and enhanced customer satisfaction.
4. The presence of effective operational factors, such as standardized processes, quality assurance mechanisms, employee training, and continuous improvement initiatives, contributes to higher product quality in the Sanabel Al-salam factory.

These findings highlight the importance of implementing operational transformation initiatives and effective operational factors to enhance production efficiency and product quality. The research underscores the significance of factors such as process optimization, automation, supply chain management, and quality control systems in achieving organizational excellence.

However, it is important to note that these conclusions are based on hypothetical calculations and assumptions. To obtain accurate and reliable results, further research should be conducted with actual data from the Sanabel Al-salam factory.

Overall, this research contributes to the existing body of knowledge on operational transformation and its impact on organizational performance. It provides valuable insights for managers and practitioners in the manufacturing industry, particularly those interested in

improving production efficiency and product quality. The findings can guide decision-making processes and inform the implementation of operational improvement strategies in similar industrial contexts.

### **Suggestions:**

Based on the findings and conclusions of this research, the following suggestions can be made for further investigation and practical implementation:

1. **Operational Transformation Implementation:** The research has shown that operational transformation positively influences production efficiency and product quality. Therefore, it is recommended for the Sanabel Al-salam factory and similar organizations to consider implementing operational transformation initiatives. This may involve streamlining processes, adopting automation technologies, optimizing the supply chain, and integrating quality control systems. The management should ensure proper planning, resource allocation, and change management strategies to facilitate a successful transformation.
2. **Continuous Improvement:** To sustain the benefits of operational transformation, a culture of continuous improvement should be fostered within the organization. This involves encouraging employees to identify and address process inefficiencies, quality issues, and other operational challenges. Regular monitoring and evaluation of key performance indicators, along with feedback mechanisms, can help identify areas for improvement and drive ongoing progress.
3. **Employee Training and Engagement:** As highlighted in the research, effective operational factors, such as standardized processes and employee training, play a crucial role in achieving higher product quality. Organizations should invest in training programs to enhance employees' skills and knowledge related to process optimization, quality assurance, and continuous improvement methodologies. Additionally, creating an environment that promotes employee engagement, involvement, and empowerment can contribute to improved operational performance.

4. **Data-Driven Decision Making:** Leveraging data and analytics can provide valuable insights for operational improvement. The Sanabel Al-salam factory should consider implementing data collection mechanisms, performance monitoring systems, and data analysis tools. By analyzing production and quality data, organizations can identify trends, root causes of inefficiencies, and areas for improvement. This data-driven approach enables informed decision-making and facilitates evidence-based strategies for operational enhancement.
5. **Collaboration and Supplier Management:** Operational transformation and improved performance often extend beyond the boundaries of a single organization. Collaborating with suppliers, implementing effective supply chain management practices, and establishing strong relationships can enhance the overall operational efficiency and product quality. Effective communication, mutual trust, and performance evaluation mechanisms are vital for successful collaboration with suppliers.
6. **Continuous Evaluation and Adaptation:** To ensure sustained improvement, it is crucial to continuously evaluate the effectiveness of operational transformation initiatives and operational factors. This can involve periodic assessments, performance reviews, and customer feedback. Organizations should be open to adapt and refine their strategies based on the evolving market conditions, industry best practices, and changing customer needs.
7. **Replication and External Validity:** The research conducted in the Sanabel Al-salam factory can serve as a foundation for further studies in similar manufacturing contexts. Replicating the research in different organizations can provide additional evidence and insights into the impact of operational transformation on production efficiency and product quality. This would contribute to the external validity of the findings and enable broader generalizations.

It is important to note that these suggestions are based on the research findings and are intended to guide the practical implementation of operational improvement strategies. Organizations should adapt these recommendations based on their specific context, available resources, and strategic goals. Consulting with industry experts and professionals in the field can provide further guidance and expertise in implementing these suggestions effectively.

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