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Analysis of the Impact of Lean Management on the Operational Performance of Organizations Case of EURL DEGLA EXPO

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ABSTRACT

In a changing global economic context, organizations need to adapt to remain competitive. Our research focuses on the impact of Lean on the operational performance of organizations. The question of this study is to determine the nature of the relationship between Lean principles and operational performance, as well as the effect of the application of these principles on this performance. Using a mixed-method approach, we combined a thorough literature review with qualitative interviews of 5 senior managers and directors. Additionally, we distributed 50 questionnaires among Degla Expo employees. the study findings highlight Lean management as a key tool for improving operational performance and show that Lean practices positively influence on operational performance.

Key words: Lean, operational performance, process improvement, quality improvement, competitiveness

Résumé

Dans un contexte économique mondial en évolution, les organisations doivent s'adapter pour rester compétitives. Notre recherche se concentre sur l'impact du Lean Management sur la performance opérationnelle des organisations. La problématique de cette étude est de déterminer la nature de la relation entre les principes Lean et la performance opérationnelle, ainsi que l'effet de l'application de ces principes sur cette performance. En utilisant une approche mixte, nous avons combiné une revue approfondie de la littérature avec des entretiens qualitatifs auprès de 5 cadres supérieurs et directeurs. Nous avons distribué 50 questionnaires aux employés de Degla Expo. Les résultats de l'étude mettent en évidence la gestion Lean comme un outil clé pour améliorer les performances opérationnelles et montrent que les pratiques Lean influencent positivement les performances opérationnelles.

Mots-clés: Lean, performance opérationnelle, amélioration des processus, amélioration de la qualité, compétitivité

ملخص

في ظل السياق الاقتصادي العالمي المتغير، تحتاج المؤسسات إلى التكيف للحفاظ على قدرتها التنافسية. يركز بحثنا على تأثير اللين على الأداء التشغيلي للمؤسسات. وتتلخص مشكلة هذه الدراسة في تحديد طبيعة العلاقة بين مبادئ اللين والأداء التشغيلي، وكذلك تأثير تطبيق هذه المبادئ على هذا الأداء باستخدام نهج مختلط الأساليب، قمنا بدمج مراجعة شاملة للأدبيات مع مقابلات نوعية مع 5 من كبار المديرين والمديرين. بالإضافة إلى ذلك، قمنا بتوزيع 50 استبيانًا على موظفي دجلة إكسبو. تسلط نتائج الدراسة الضوء على الإدارة اللينة كأداة رئيسية لتحسين الأداء التشغيلي وتظهر أن الممارسات اللينة تؤثر بشكل إيجابي على الأداء التشغيلي.

الكلمات المفتاحية: اللين، الأداء التشغيلي، تحسين العمليات، تحسين الجودة، القدرة التنافسية

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LISTE OF ABBREVIATIONS

VSM: Value Stream Mapping

TPS: Toyota Production System

MIT: Massachusetts Institute of Technology

SMED: Single Minute Exchange of Die

TPM: Maintenance Productive Total

SPSS: Statistical Package for the Social Sciences

IMVP: MIT International Vehicle Program

ERPS: Enterprise resources planning

KPI: Key performance indicators

Introduction

Introduction

The transition to a knowledge-based economy has profoundly reshaped the business landscape, requiring organizations to achieve unprecedented agility and efficiency to thrive in a constantly evolving competitive environment. In this context, operations management is of paramount importance, as it is the main driver of companies' performance and competitiveness.

In recent years, the evolution of the global economic landscape has forced businesses to adapt to new challenges such as increased competition and globalization. In this context, quality has become a fundamental requirement for customers, prompting companies to constantly seek innovation as a means to ensure their growth and development.

Innovation indeed plays a crucial role in enabling the development of new products and the improvement of existing product quality, which adds value for customers. This can help enhance the overall performance of the company and maintain its competitiveness in the market.

Among the most notable forms of innovation today are managerial or organizational innovations. These refer to an organization adopting new management practices or methods to improve its overall performance. It is, in fact, a complex process that can affect various aspects of the organization and requires mastery, steering, and continuous improvement. (Roy, ROBERT, & GIULIANI, 2013)

In the food production sector, many companies are seeking new production systems that meet performance improvement objectives and promote a continuous improvement approach. To achieve this, these companies must design products that are easily manufacturable and select the most effective and efficient process for their production, thereby minimizing waste and achieving optimal results.

In this perspective, inspired by the Toyota Production System and developed by researchers at the Massachusetts Institute of Technology (MIT) in the United States, Lean management derives its name from the idea of "lean," which evokes the elimination of the superfluous and the focus on the essential, fundamental principles of this approach. Lean management is an approach aimed at improving the overall performance of the company, particularly regarding the quality and profitability of its production. (Huser, 2022)

This methodology aims to optimize processes to reduce non-productive times by eliminating sources of defects and simplifying operations. It also relies heavily on a managerial aspect aimed at creating an optimal work environment for employees. In summary, its central goals are total customer satisfaction and the individual success of each employee. (Huser, 2022)

Implementing a Lean system within a company is a process that can span several years. The key to this approach lies in empowering the various stakeholders, which requires extensive training efforts, both technical and methodological, as well as the establishment of routines and tools, both organizational and managerial.

Moreover, integrating Lean management necessitates profound changes within the organization of the company. This involves significant modifications in daily tasks and the company's structure in terms of production processes, to eliminate everything superfluous and achieve substantial productivity gains.

Research Problem

In Algeria, the evolving economic landscape and the predominance of intense competition compel the country's businesses to reassess their management organization on one hand and their commercial strategy on the other. They must adapt to new competitive challenges by investing in the modernization of their managerial and technological capacities, while anticipating market opportunities and threats. This translates into the adoption of new managerial approaches focused on innovation, continuous quality improvement, and cost reduction by optimizing the use of available human, material, and production resources.

This research aims to examine the relationship between the two main variables of our study, namely Lean management and operational performance. This leads us to pose the following problem: **Is there a link between the application of Lean management principles and the operational performance of the company?**

To delve deeper into our research topic, we have posed the following secondary questions:

- If there is a link between the two variables studied, what would be the nature of this link?
- How does the application of Lean management principles impact the operational performance of the organization?

Based on these questions, we have formulated two main hypotheses:

- **Hypothesis 1 (H1):** There is a positive link between the application of Lean management principles and the operational performance of the company.
- **Hypothesis 2 (H0):** There is no significant link between the application of Lean management principles and the operational performance of the company.

Research Objectives

This study primarily aims to:

- Main Objective: Determine if there is a significant link between the application of Lean management principles and the operational performance of companies.

Secondary Objectives:

- Identify the nature of the link between the application of Lean management principles and the operational performance of companies.
- Examine how the application of Lean management principles impacts the operational performance of organizations.

Research Methodology

To analyze the impact of Lean management on operational performance at Degla Expo, this study adopts a mixed approach, combining qualitative and quantitative methods. Qualitative interviews are primarily used to understand the perspectives and responsibilities of managers, executives, and employees regarding the application of Lean management principles, as well as the relationship between Lean management and operational performance. Concurrently, a quantitative analysis of questionnaire results is conducted to assess the impact of Lean management on the organization's operational performance.

Relevance of the Research

Lean Management, as an organizational philosophy, can be applied to various types of organizations and across a multitude of sectors. It embodies a fundamental approach aimed at achieving optimal performance through continuous improvement, with the goal of satisfying customers by enhancing productivity, quality, lead times, and costs. This research seeks to demonstrate how the adoption of Lean Management principles can be beneficial and necessary for resolving and optimizing operational performance issues.

Research Structure

The structure of this study is as follows:

- **Chapter 1: Literature Review and Conceptual Framework**
  This chapter examines existing research to deepen our understanding of Lean Management and operational performance.
- **Chapter 2: Research Methodology**
  This chapter discusses the research methodology and techniques employed to answer the research question.
- **Chapter 3: Case Study and Analysis of Results**
  This chapter presents the organization in question, analyzes the obtained results, and proposes relevant discussions.

Chapter 01: Literature Review and Conceptual Framework

In this chapter, we present in the first section a general review of various publications related to the variables and the subject of the study. We will also address the conceptual framework of the study, which will be divided into the second section on lean management and a third section on operational performance.

1. Section 01: Literature Review

As part of our thesis work, we have examined a variety of articles and theses relevant to our problem or dealing with similar topics. Our goal was to explore research already conducted in our field to enlighten our own study.

To structure our work effectively, we relied mainly on fundamental works recognized for their relevance to our subject. We also integrated other relevant articles, carefully selected for their significant contribution to our literature review and our research domain.

Early on, several studies laid the foundations of Lean by describing the Toyota Production System and introducing key Lean Management concepts (Taiichi, 1988), Taichi Ono's book focuses on the Toyota Production System (TPS), also known as lean manufacturing. It explores methods to increase efficiency and productivity in manufacturing processes by reducing waste and improving production processes. As the Executive Vice President of Toyota Motor Corporation, Ono adopts a multidimensional approach, including direct observation of production processes, analysis of production data, interviews with personnel, and the use of case studies to illustrate TPS principles. Key results obtained through TPS include cost and waste reduction, improved product quality, increased productivity per employee, greater flexibility to adapt to demand changes, reduced inventory, increased employee motivation, and enhanced market competitiveness. However, the book has been criticized for its limited applicability outside the automotive industry and its inadequacy in addressing human aspects compared to technical aspects.

In the same context of establishing the foundations of Lean management, another notable study is that of (Shigeo, 1988) , which aims to provide a more comprehensive approach to stock elimination and operational improvement. Shingo focuses on completely eliminating stocks and waste in production processes while constantly improving efficiency. Drawing on his expertise in industrial engineering and observing the implementation of the Toyota production system, Shingo developed concepts such as SMED (Single-Minute Exchange of Die) and continuous flow lines. His approach

is based on flow-based production concepts, such as stockless Kanban, to reduce inventory and improve productivity. Emphasizing quick detection and resolution of problems, his system aims to improve product quality and free up valuable storage space. However, his approach has been criticized for implementation challenges, cultural transformation, and universality of principles. Although published in 1988, his system requires adaptation to contemporary developments in quality and production, and its integration into corporate culture can be complex.

Following studies that introduced Lean Management under its common name and defined it as a management style and philosophy, we find the study conducted by(Emiliani, 1998) , which aims to understand how Lean behaviors influence organizational success and long-term value creation. Emiliani used various methods, including a survey conducted within the equipment department of a spacecraft materials manufacturer, distributing questionnaires to 45 employees, analyzing the collected data using the Statistical Package for the Social Sciences (SPSS) program, and comparing results before and after Lean process implementation. The main objective of the study was to increase productivity. By examining the information gathered from surveys and questionnaires, the study emphasized the importance of developing individual problem-solving skills in the context of Lean operations management. The results highlighted the beneficial impact of Lean behaviors on organizational performance and the successful implementation of Lean principles in the workplace. Various sources responded to criticisms of the study regarding Lean behaviors and thinking. A major criticism is that the study did not fully consider the potentially adverse consequences of Lean practices on employees, such as job loss and increased work stress, as emphasized in Emiliani's book, "A Critique of Lean," which highlights the importance of understanding historical context and considering individuals in the field of Lean Management. Additionally, some critics argue that the study did not provide a comprehensive view of the relationship between Lean behaviors and Lean thinking, as it focused more on individual factors motivating employees to adopt Lean change rather than broader aspects of organization and leadership.

Although the approaches and methods used differ across studies, that of (Holweg, 2007), focuses on the development of just-in-time production and how it challenged established mass production methods in the automotive industry. The study examines research progress made under the MIT International Motor Vehicle Program (IMVP) that led to the creation of the "just-in-time" concept

and seeks to understand why this program had such an influence in promoting this concept, despite pre-existing knowledge of Just-in-Time (JIT). Holweg explores the origins, principles, and development of lean production, highlighting its historical context and factors influencing its adoption in administrative processes. The results provide a detailed view of the origins and principles of lean production, as well as elements that influenced its development and its impact on operations management. However, criticisms have been raised regarding the excessive simplification of the lean production concept, the lack of detailed documentation on its development, and the focus on fear and hope rather than logistics and organizational understanding.

While these books and articles presented the history of Lean management, provided a definition, and explained its concept along with its various principles and methods, many researchers were applying these methods in the field. According to the study by (Rother & Shook, 2003), companies can effectively use value stream maps to visualize their production processes, identify sources of waste (muda), and create value for their customers by eliminating them. The study presents a methodology called "Value Stream Mapping" to improve operations and create value for customers. This method uses value stream maps to identify waste in production processes and proposes solutions to eliminate them, thereby improving operational efficiency. The study's results highlight the effectiveness of this method in improving processes, reducing costs, and increasing quality. However, some critics note its failure to address the real complexity of industrial and organizational processes, as well as the lack of empirical evidence to support the presented results. Nevertheless, the study offers a practical guide for creating value in production processes.

Next, the study conducted by (Jimmerson, Weber, & Sobek, 2005) oversees the application of the Toyota Production System (TPS) in the healthcare context to improve efficiency and quality. It aims to enhance the efficiency and quality of healthcare operations at Intermountain Healthcare by applying Lean principles based on the Toyota Production System (TPS). The use of tools such as A3 reports and value stream maps has identified and prioritized sources of waste in healthcare delivery processes. The implemented improvements have led to a significant reduction in time wasted for frontline workers, thereby enhancing hospital operational efficiency. However, the study is criticized for its lack of comparison with other quality management approaches or process

improvement, as well as its lack of specific data on the impact of Lean initiatives on clinical outcomes for patients.

In another approach to Lean Management, the study conducted by (Ohno & Sturen, 2012), aims to address challenges related to productivity, quality, and overall performance in the pipe manufacturing domain by focusing on Lean principles. Researchers analyzed existing processes and then conducted an in-depth study of the production methods used. In this analysis, it was necessary to directly monitor processes and collect information on workflow. Waste was observed in various manufacturing processes, such as excessive transportation, excess inventory, quality defects, waiting times, and overproduction. The authors applied various tools and methods such as value stream mapping, 5S, Kaizen (continuous improvement), and SMED. They also collected quantitative data on key performance indicators such as productivity, cycle time, production costs, and inventory to assess the impact of Lean interventions. Ohno and Sturen examined the information to assess progress, which required an analysis of results before and after intervention, as well as a qualitative evaluation of observed changes in production processes. The results showed a reduction in inventory, improved productivity and quality of pipes, as well as increased customer satisfaction and reduced expenses. However, critics highlight the absence of consideration for external variables and potential obstacles, limiting a comprehensive understanding of the implications of Lean production in pipe manufacturing processes.

Subsequently, many studies have opened new horizons in the application of Lean management methodology and its development to adapt it to the application of other administrative and economic concepts. Some have linked Lean management to agility, as indicated in the study conducted by(Narasimhan, Swink, & SooWook, 2006) , which aims to clarify the concepts of "lean" and "agility" in the context of operations management and the supply chain. Swink and Kim conducted empirical research, analyzing the relationships between leanness, agility, and firm performance using statistical methods. The authors examined key factors influencing firm performance in terms of leanness and agility, highlighting the importance of supply chain integration, innovation orientation, and competitive advantage over firm leanness and agility. They identified key factors influencing firm performance in terms of leanness and agility, showing that these concepts are essential for improving business process efficiency and addressing market uncertainties. However, this study has faced some criticisms, including the lack of longitudinal

data, limiting the ability to draw causal conclusions about the relationship between agility and lean. Additionally, theoretical perspectives are also limited due to their lack of reference to deeper theoretical frameworks or their inability to integrate multiple theoretical perspectives into the analysis.

There are also studies highlighting the concept of Lean in industry, such as that conducted by (Tortorella & Fettermann, 2018) , which explains how the simultaneous adoption of Industry 4.0 and Lean production influences the improvement of operational performance in manufacturing companies in Brazil. Their study surveyed 109 Brazilian manufacturing companies to assess their implementation of Lean production principles. They used quantitative methods such as statistical analyses and structural equation models to examine the links between Lean practices, Industry 4.0 technologies, and operational performance. The results showed that the joint adoption of Industry 4.0 and Lean production had a positive impact on improving the operational performance of manufacturing companies in Brazil. However, specific conclusions for the Brazilian context may not be generalizable to other countries or sectors, and the study would have benefited from a stronger theoretical framework to explain the links between lean management, Industry 4.0, and operational performance.

The study conducted by (Buer, Strandhagen, & Semini, 2021) examines the integration of Lean principles and digitalization in material supply for manufacturing industries. Its main objective is to combine Lean practices to reduce waste with digital technologies, thus assessing the challenges and benefits of a digitized material supply system in a production context. It also aims to design such a system that adheres to Lean principles while using emerging technologies such as IoT and Big Data. This qualitative study was conducted in a Norwegian manufacturing company, using semi-structured interviews and direct observations to collect data. The authors developed a conceptual framework describing the essential elements of a digitized material supply system based on Lean principles, while highlighting its benefits, success factors, and challenges to be addressed during implementation. However, critics question the validity of the conclusions, the relevance of measurement methods, and the interpretation of results, pointing out gaps, potential biases, or methodological limitations in the research.

There are also studies shedding light on the relationship between lean management and the date export sector, such as the study conducted by (Boudeba, 2016) , which examines how the

implementation of lean production influences the export competitiveness of Algerian dates. Through various case studies conducted within several exporting date companies, information was gathered through interviews, observations, and documentary analysis before being qualitatively analyzed. The results indicate that lean production can improve productivity, quality, and responsiveness but faces cultural, organizational, and financial challenges. For successful implementation, a profound change in corporate culture is necessary with support from public authorities, particularly in terms of training and financial support. Recommendations include raising awareness and training of leaders and employees, management involvement, mobilization of necessary human and financial resources, as well as the establishment of public programs to support lean production. However, criticisms are made regarding the generalization of results, the qualitative methodology used, the selection of studied companies, the lack of quantitative data on performance improvements, and the concise analysis of obstacles to lean adoption. The recommendations are deemed general and would require further study for implementation.

The article by (Laghrissi & al, 2019) aims to assess how the application of Lean principles can improve the management, productivity, and profitability of the date supply chain, highlighting the benefits and challenges encountered in this context. For this purpose, a thorough study of the existing logistics chain was conducted to identify losses and sources of non-value-added. Improvement suggestions were made using Lean tools such as value stream mapping, 5S, and Kanban. This approach led to a reduction in inventory and work in progress, better coordination among different actors in the chain, increased productivity and competitiveness, as well as improved quality of exported dates. As a result, recommendations were made, such as staff training on Lean principles, engagement of all stakeholders in the improvement process, establishment of a performance measurement system, and sustainability of new Lean principles. However, the results may be limited as the technical aspects of optimizing the logistics chain are not fully addressed, and even though the need for a performance measurement system is mentioned, details on key indicators and their evaluation are neglected. Finally, the study recommends maintaining long-term improvements but does not address long-term success factors to ensure their sustainability.

The article by (Alami & al, 2021) takes an approach involving a preliminary analysis of the production process, detection of the most frequent types of defects, and application of the DMAIC

cycle of Six Sigma as well as Lean tools such as VSM and 5S to improve flows. The results demonstrate a notable decrease in the defect rate, productivity improvements and savings, increased customer satisfaction, as well as a more efficient organization of the production process. Staff training and engagement in continuous improvement, establishment of a statistical process control system, and regular Lean audits to maintain progress are among the recommendations. However, the specificity of the date context restricts the possibility of generalizing the results to other sectors. Additionally, despite the presence of quantitative results, the article does not provide details on measurement and analysis methods, raising questions about data reliability. Challenges related to human factors and sustainability of improvements are not extensively addressed. Similarly, there is no in-depth cost-benefit analysis or comparison with other quality improvement methods, restricting the overall view of the study.

The study by (Rahman, Laosirihongthong, & Sohal, 2010) examines the influence of implementing a Lean production strategy on the operational performance of manufacturing companies. The authors created a conceptual model based on lean manufacturing principles and dimensions of operational performance. They developed a survey to assess the variables of the conceptual model, distributing the questionnaire to a sample of 115 manufacturing companies in Thailand to collect empirical data. Then, data analysis was conducted using statistical methods such as exploratory factor analysis, reliability analysis, and structural equation model simulation. This combined approach of qualitative and quantitative methods allowed for empirically analyzing the influence of Lean approaches on production operations. Four main Lean practices were identified during factor analysis: Lean human resource management, supplier relationships, Lean production practices, and Kanban/production flow. According to the results, applying a Lean approach has a significant impact on aspects of operational performance such as costs, quality, delivery, and flexibility. The most influential practices relate to human resource management and supplier relationships. However, the study has limitations, including its small size and focus on a single country, making it difficult to generalize the results to other cultural and industrial contexts. Additionally, the cross-sectional nature of the study makes it challenging to establish clear links between Lean practices and performance, and the analysis of sectoral contingencies is limited as the study primarily focuses on internal Lean performance.

The study conducted by (Nawanir, Teong, & Othman, 2013) examines the impact of Lean practices on the operational performance of manufacturing companies in Indonesia. The authors employed various techniques in their study, including a cross-sectional survey. Samples were chosen from large Indonesian manufacturing companies using a stratified random sampling method. They then developed and statistically tested four main hypotheses using multivariate data analysis. According to the results, it is essential to implement Lean practices comprehensively, as they have a positive and significant effect on both operational and business performance. Additionally, operational results partially mediate the correlation between Lean methods and business outcomes. However, some criticisms have been raised regarding the methodology used, particularly concerning the generalizability of the results and the possibility of biases related to self-reported data. The data used in the study mainly came from self-reports of middle or senior managers, which could introduce potential biases into the results. Furthermore, although the study demonstrated a positive and significant impact of Lean practices on operational and business performance, it is important to consider these limitations when interpreting the results.

The study by (Chavez & al, 2013) stands out from others by seeking to understand to what extent the adoption of Lean practices improves operational performance and whether this effect is moderated by the fast or slow pace of the industry in which the company operates. The researchers used a combination of quantitative methods, including regression analysis, to analyze the relationships between internal Lean practices and operational performance in different industrial contexts. This methodological approach allowed for assessing the contingent nature of Lean practices and their effectiveness depending on the pace of the industry in which organizations operate. The study's results revealed a positive relationship between internal Lean practices and quality, delivery, flexibility, and cost. However, the industry clock speed attenuated this relationship, except for cost. This underscores the importance of considering the pace of industry changes when implementing Lean principles to improve operational performance. Despite these contributions, the study was criticized for needing a more in-depth exploration of the mechanisms by which industry clock speed moderates the relationship between internal Lean practices and operational performance. Additionally, a more comprehensive analysis of contextual factors influencing this relationship could enrich the understanding of Lean implications in different industrial environments.

Taken together, these studies offer a comprehensive and nuanced perspective on Lean Management, exploring its foundations as well as its most recent developments, highlighting its potential to sustainably improve organizational performance. Our study primarily aims to examine the relationship between Lean Management principles and operational performance, as well as to analyze the impact of applying these principles on operational performance in the date export sector.

2. Section 02: Overview of Lean Management

This section of the dissertation is dedicated to providing a general presentation of Lean Management. We will address the history and evolution of this approach, as well as its definitions, objectives, and fundamental principles. In concluding this section, we will also examine the different methods associated with Lean Management.

2.1. History and Evolution of Lean Management

Following World War II, Japanese industries were compelled to deeply revise their methods to cope with an economic downturn. This situation prompted Taiichi Ohno, an industrial engineer at Toyota, to conceive the Toyota Production System (TPS) with the aim of rationalizing production costs, reducing product prices, and increasing competitiveness in the market. This innovative system, focused on the "just-in-time" approach, aimed to reduce waste, maintain high quality standards, adopt continuous production flow, integrate frontline staff suggestions, and pursue continuous improvement. (Clarisse, 2013, p. 21)

In-depth study of the TPS began in the 1970s, with researchers such as Sugimori and colleagues, culminating in an inaugural conference in 1980 by Ohno and Kumagaï. Subsequently, works such as Monden's in 1981 contributed to the dissemination and understanding of this innovative system. After the oil shock of 1973, the TPS became a crucial pillar for Japan's economic recovery, helping to restore lost industrial competitiveness. Initially influencing primarily, the automotive industry, it gradually sparked interest in other industrial sectors, thus establishing its reputation as an indispensable reference for effective production management. (Emilie, 2012, pp. 1-3)

The Massachusetts Institute of Technology (MIT) played a crucial role in developing the concept of "Lean" in 1987, later consolidated by (Womack, Jones, & Roos, 1990). Their synthesis resulted from a thorough analysis of the operations of major global automakers, especially Toyota, highlighting the significant contributions of engineers Ohno and Shigeo Shingeo in the 1950s.

The evolution of Lean Management continued with the publication of subsequent works, such as that of (Hohmann, 2012) , which enriched the understanding of this effective management model. Furthermore, studies were conducted to explore the specific conditions for applying Lean Management in Japan. The works of Dominici and Palumbo in 2012, as well as those of Bortolotti et al. in 2015, analyzed the impact of Lean Management on organizational culture and internal

practices. Concurrently, Chavez et al. in 2015 examined the synergies between Lean Management and technological advancements. These research efforts converge towards demonstrating the positive impact of Lean management on overall organizational performance. (Meriem & Mohamed, 2018, p. 59)

Therefore, Lean Management is not limited to a mere management model; it represents a business philosophy that continues to inspire and transform how organizations operate and adapt to the constant challenges of the global economy.

2.2. Definition of Lean Management

The term "Lean" derives from the English word "Lean," meaning "thin" or "trimmed." Although the core concepts of Lean emerged in the early 20th century, the term itself only became widely used from the 1990s. (Julia, 2015, p. 15)

According to Christian Hohmann, Lean is a systemic approach aimed at designing and improving processes to achieve an ideal state centered on customer satisfaction, involving the entire staff whose initiatives are aligned with Lean principles. He also describes Lean as a system aiming to maximize added value while minimizing costs and lead times, using necessary resources to meet customer requirements. (Sow, 2018, p. 19)

Michael Ballé states that Lean is a management method that seeks to improve company performance by developing the skills of all employees. (Sow, 2018, p. 19)

According to Clarisse, Lean Management is a process focused on improving company performance by eliminating waste, aiming to meet customer requirements in terms of quality, costs, lead times, and responsiveness. (Clarisse, 2013, pp. 21-22)

Kerry Gleeson argues that the Lean approach is a continuous process of identifying, resolving, and eliminating errors that hinder a regular production flow. He adds that Lean is also a way of thinking, a posture of doing better with less energy. (Fairouz & Nadia , 2021, p. 06)

According to some authors, such as Chassende-Baroz et al., the Lean program consists of various transformations of flows, technical production conditions, and management practices, aiming to identify defects and reduce losses within the organization. (Fairouz & Nadia , 2021, p. 05)

According to Womack and Jones, Lean Management is not limited to a mere "technique" but constitutes a comprehensive management approach aimed at keeping the company under creative tension, thus promoting continuous value generation by eliminating waste, while also being considered as a skill. (Womack, Jones, & Roos, 1990, pp. 48-67)

By synthesizing the definitions proposed by numerous researchers and authors, it can be affirmed that Lean Management is a systemic management approach focused on optimizing operational processes to maximize value for the customer while reducing waste. To achieve an ideal state centered on customer satisfaction, this approach relies on the continuous elimination of

inefficiencies, the participation of all employees in continuous improvement, and the optimization of workflow.

Moreover, it can be asserted that this method encourages a culture of continuous improvement, prompting everyone to contribute to the search for more efficient practices. Going beyond a simple set of methods, Lean Management represents a comprehensive philosophy aimed at reducing unnecessary costs, increasing customer value, and promoting continuous innovation.

2.3. Objectives of Lean Management

Over the past decade, many companies from various sectors have adopted the Lean system to respond to market pressure and competition. The impact of applying Lean principles on company performance has been the subject of numerous studies, revealing significant improvements in operational, administrative, strategic, and human areas. Despite remarkable results, such as reducing stocks by over 50%, increasing productivity by over 50%, and improving working conditions and staff motivation, not all companies have achieved the expected results despite pursuing goals of cost reduction and waste elimination. (Lyonnet, 2015, pp. 19-21)

According to Lyonnet, companies adopting a Lean approach frequently aim for these objectives to improve their operational performance and market competitiveness:

- **Stock reduction:** Lean aims to reduce inventory levels in the company, thus freeing up financial resources and improving operational flexibility;
- **Increased productivity:** Lean aims to improve process efficiency and productivity, resulting in increased production per unit of time or labor;
- **Improvement of working conditions:** Lean aspires to create a work environment where employees feel valued and motivated, which can reduce stress, improve work organization, and increase employee involvement in decision-making processes;
- **Cost reduction:** Lean focuses on eliminating waste and inefficiencies in processes, resulting in reduced production costs and improved company profitability;
- **Waste elimination:** Lean seeks to identify and eliminate activities that do not add value for the customer, thus optimizing processes and reducing costs.

However, it is essential to note that the results of applying Lean principles can vary from one company to another depending on various factors such as organizational culture, employee skills, and market conditions. (Lyonnet, 2015, p. 27)

According to (Demetrescoux, 2017, pp. 17-19), the main objective of Lean Management is to develop efficient, stable, and robust processes by controlling, stabilizing, standardizing, and constantly improving processes in all areas of the company. This approach also aims to achieve several main objectives:

- **Continuous improvement:** Lean Management aims to establish a culture of continuous improvement, where every employee is encouraged to identify problems, propose solutions, and participate in their resolution.
- **Engagement of every participant:** It relies on the commitment of all employees in the organization, regardless of their hierarchical level, to improve processes and company results.
- **Development of individuals:** Lean Management concerns itself with the growth of employees' skills and capabilities, creating an environment conducive to learning, growth, and significant contribution to the company.
- **Sustainability and company growth:** By improving competitiveness, reducing waste, and effectively meeting customer needs, Lean Management aims to ensure the sustainability and growth of the company.

(Dies & Vérilhac, 2017, p. 13), also emphasize that customer satisfaction, company competitiveness, and the creation of a culture of continuous improvement involving all stakeholders of the organization are objectives of Lean Management, including:

- Meeting customer requirements in terms of quality, costs, and lead times;
- Achieving a high level of competitiveness;
- Establishing a Lean mindset involving all stakeholders of the company.

In conclusion, the Lean Management approach aims to improve companies' operational performance, competitiveness, and customer satisfaction by increasing productivity, improving working conditions, reducing costs, and eliminating waste. However, results may vary depending on organizational culture, employee skills, and market conditions. Companies must adopt an

adaptive approach, invest in training, promote a culture of continuous improvement, and overcome organizational challenges to succeed in implementing Lean Management.

2.4. Fundamental Principles of Lean Approach

This section is dedicated to presenting the fundamental principles of the Lean approach. We will address waste elimination, just-in-time, continuous flow, continuous improvement, respect for people, and conclude this part by discussing integrated quality.

A. Waste Elimination (Muda): The pursuit of waste elimination, also known as Muda in Japanese, involves identifying and eliminating activities that consume resources without adding value in any process. The customer is willing to pay for what they perceive as value. While sometimes necessary, Muda does not generate any value for the buyer. It is imperative to identify and reduce, or even eliminate, them. Lean Management is based on this approach, which includes examining current processes or, more proactively, when creating new production methods. (Demetrescoux, 2019, p. 12)

Taichi Ohno, a pioneer at Toyota, carefully examined this approach. He demonstrated that operators spend as little time as possible creating added value. The rest is considered waste. Stocks created during production require numerous movements, transports, and immobilized expenses, which require time-consuming management and occupy space without adding value to the customer. Ohno classified seven common categories of waste in production, but these ideas apply to all areas (Demetrescoux, 2017, p. 30).

- Overproduction represents a significant form of waste, leading to other forms of waste by producing more than necessary or prematurely.
- Waiting refers to any resource on standby, whether it's an individual, a machine, or material.
- Movement of resources (personnel, raw materials, information).
- Excessive storage of materials compared to the minimum requirements needed for work.
- Unnecessary, strenuous, or hazardous personnel movements.
- Defects resulting in losses such as degradation, repairs, sorting, or rework that do not meet quality standards from the start.
- Unnecessary or excessive processes creating unnecessary complexities.

The 3Ms of Waste: According to ergonomics specialists, priority should be given to the elimination of overburden (MURI) rather than the reduction of variability (MURA). This first reduces stress and fatigue. It's easier to spot waste (MUDA) in a more serene environment: (Demetrescoux, 2019, p. 14)

- **Muda (waste):** This refers to any activity devoid of added value, i.e., that does not contribute to satisfying customer needs. Typical forms of waste include overproduction, waiting times, unnecessary transportation, excess inventory, unnecessary movements, defective production, and overprocessing.
- **Muri (unnecessary efforts):** This refers to situations where individuals, equipment, or facilities are subjected to excessive stress, for example, due to overload, dangerous operations, or unsustainable rhythms. This can lead to breakdowns, malfunctions, and quality problems.
- **Mura (irregularity):** This waste concerns inconsistency or inequality in production processes. This can manifest as demand fluctuations, variations in work methods, or irregularities in the quality or quantity of products or services manufactured. These variations waste time, resources, and energy to adapt to changes.

B. Just-in-Time (JIT): The concept of Just-in-Time (JIT) was introduced by Taiichi Ohno in the 1950s at Toyota's Honsha plant in Japan. Originally, this concept was applied to the supply processes of the assembly and machining workshops at this factory. Just-in-Time is based on several key concepts, including production leveling, adoption of Kanban methods, continuous flow of parts, and reduction of changeover times between production runs. (Lyonnet, 2015, p. 26)

The Just-in-Time (JIT) strategy highlights the following principles: (Blondel, 2005, pp. 279-280)

- To meet customer needs, it is necessary to completely eliminate delays, ensure absence of defects, and protect information.
- To reduce production costs, it is crucial to minimize manual operations, avoid production stops, and maintain minimal inventory.
- To increase responsiveness and efficiency, it is recommended to produce only on demand, not unnecessarily, split batches, avoid complete breakdowns, and simplify accounting management.

Regarding benefits, JIT offers several advantages: (Lyonnet, 2015, p. 27)

- Reduction of storage and handling costs.
- Elimination of potential defects to improve quality.
- Reduction of lead times and faster response to customer demands.
- Optimization of production processes by reducing waste and promoting strictly necessary production.

C. Continuous Flow (Jidoka): Jidoka, originating from Japan, is a concept that combines autonomy and automation. It constitutes one of the main pillars of the Toyota Production System, alongside just-in-time. Jidoka involves the nearly autonomous operation of machines, aiming to enable an operator to supervise multiple machines simultaneously, thereby reducing the need for constant machine monitoring. By promoting employee versatility, Jidoka greatly contributes to process flexibility by separating production flow from workflow, distinguishing human actions from those of machines. (Landry & Beaulieu, 2021, pp. 56-57)

The "stop at the first defect" principle of Lean methodology aims to ensure quality by interrupting operations as soon as a defect appears. This approach allows for quick problem identification, immediate solution finding, or reporting of a more serious anomaly.

The concept of Jidoka is based on several fundamental principles. First, it involves signaling any problem, stopping, and taking the time to understand the situation to react appropriately. It is imperative never to let a defect pass to the next step in the value chain. Secondly, this concept emphasizes the distinction between people and machines, allowing individuals to work autonomously relative to machines and not monitor them constantly. The idea is for humans to be used by machines rather than the reverse, which also aligns with autonomy. Jidoka is not solely focused on defect prevention; it also integrates the notion of real-time, which is an essential element of Lean dynamics. Understanding the circumstances, environment, or situation in which a defect occurs is crucial to being able to react promptly. When a defect is detected, the operation is immediately stopped, thus preserving the conditions of the defect as initially observed, akin to an "unadulterated crime scene." Moreover, there is a real-time temporal dimension aimed at spotting "weak signals" indicating a trend before it manifests. These signals serve as an early warning; the problem has not yet occurred. In more general terms, Jidoka requires the immediate cessation of any activity, whether performed by the machine or the operator, upon detection of a

problem. Employees are thus encouraged and empowered to interrupt a process as soon as a problem arises. (ROCHE, 2015, pp. 19-20)

D. Continuous Improvement (Kaizen): The concept of Kaizen represents a continuous improvement approach in production processes. This term, a combination of the Japanese words Kai (change) and Zen (good), aims to constantly modify existing tools and methods to improve overall efficiency. Kaizen is not limited to a single technique but rather constitutes a mindset requiring the participation of all employees and leaders. It is favored when implementing a continuous improvement strategy, integrating several other tools such as PDCA, TQM, and SMED, which are used in concert. Kaizen is a philosophy based on problem-solving tools adapted to a given context, and it is not limited to a specific tool. (Delers & Feys, 2015, pp. 11-12)

The goal of the Kaizen method is to reduce seven traditional, fundamental types of waste, which may occur within a company: (Charles, 2021, p. 26)

- Overproduction, often associated with high-flow production.
- Waiting, whether for products or personnel.
- Unnecessary transportation and handling, not valued by the customer.
- Non-conformities, rework, and repairs, often underestimated or overlooked.
- Excessive inventory, resulting from overproduction.
- Unnecessary or micromovements, related to ergonomics or personal actions.
- Superfluous processing steps.

The benefits of Kaizen are manifold. In addition to fundamental benefits such as improved quality, productivity, and working conditions, other benefits can be identified: (Delers & Feys, 2015, pp. 21-22)

- The principle of Kaizen promotes gradual change within teams. Adjustments made by operators themselves reduce the pressure associated with major changes.
- This method encourages acceptance of changes and motivates employees to feel involved and valued. Engaged teams are more motivated when workstations are improved, generating renewed enthusiasm that encourages ongoing Kaizen improvement thinking.

- Kaizen adherence facilitates quick results. Teams reduce the risk associated with implementing new machinery or software by quickly testing small improvements to assess their relevance.
- Finally, Kaizen enables companies to meet competitiveness requirements without requiring significant resources or investments.

E. Respect for People: The concept of respect for people comes to life through the involvement of individuals who collaborate, communicate, solve problems, and evolve together, in line with the philosophy of the Toyota Way. This approach requires not only encouragement but also active participation and engagement of employees. The "Toyota Way 2001" places great importance on the human aspect of Lean Management by highlighting two principles: (Liker & Meier, 2005, p. 258)

- Respect, which involves showing consideration for others by seeking to understand their perspectives and fostering the growth of mutual trust.
- Teamwork, aiming to promote personal and professional development, exchange growth opportunities, and maximize individual and collective performance.

In a continuous flow, the entire production line is stopped in case of a problem. While this may seem like an unfavorable manufacturing system at first glance, it necessitates that all team members immediately address the problem whenever a production interruption occurs. Consequently, team members are encouraged to reflect and grow through this reflection, becoming more competent individuals and team members. Respect for people goes beyond a mere set of efficiency and improvement methods. Employees identify latent problems and solve them, experiencing a sense of urgency, purpose, and teamwork, as failure to address a problem would result in a production breakdown. It is essential to have involved leadership, adequate training, and a culture that integrates the perpetuation of improvement into all activities, from the shop floor to the boardroom (Olivier, 2009, p. 26)

F. Integrated Quality (Poka-Yoke): Poka-Yoke is a combination of the Japanese terms "Poka," which means "error," and "Yoke," which means "prevent." In case of a problem, Poka-Yoke interrupts subsequent operations to prevent mechanical or human errors in a simple, effective, and economical manner. Its goal is to achieve zero defects without requiring inspection. It is a method

of problem thinking and evaluation, divided into two main categories: (Demetrescoux, 2019, p. 143)

- Stop Poka-Yoke, intended to prevent defects or machine operation interruptions.
- Alert Poka-Yoke, which produce signals or warnings to inform the operator when an anomaly is detected.

Poka-Yoke is built upon several operational principles, including the principle of tactile detection, the principle of counting predetermined movements for detection, and the principle of error detection in standard machine movement sequences (Demetrescoux, 2019, p. 143)

Error prevention efforts are organized hierarchically. The highest level aims to completely avoid errors, although total elimination is not always practical or achievable. Even if an error prevention device is used, "protection barriers" must be in place to ensure that the customer is not at risk, thus ensuring quality and customer satisfaction. It should be noted that error prevention goes far beyond simply preventing defects, applying to any professional activity and any deviation from the defined norm. (Liker & Meier, 2005, pp. 195-190)

2.5. Lean Management Methods

Lean Management is implemented through a diverse range of methods. Indeed, the diversity of industrial sectors, organizational dimensions such as size and structure, as well as culture, require an adaptation of these methods to the specific reality of each organization. In this section, we will examine the different methods of Lean Management.

2.5.1. Process Analysis Methods

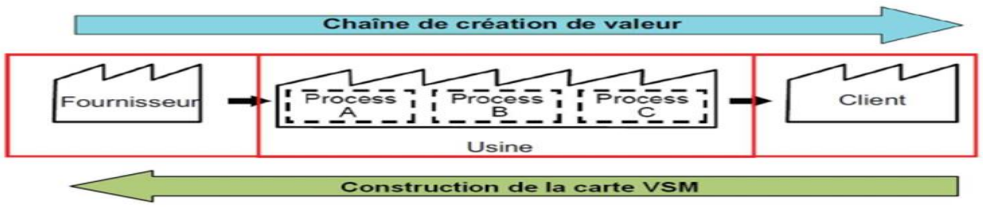
In this section, we will explore process analysis methods within the Lean approach, such as value stream mapping, Ishikawa diagram, Pareto principle, and the 5 Whys. These tools are of crucial importance in evaluating operations within an organization.

A. Value Stream Mapping (VSM): Value stream mapping, also known as VSM, is a visual representation method used to identify and illustrate material and information flows within a process. This fundamental tool of Lean Management aims to visualize and improve the process by eliminating steps that do not add value to the customer. (Dumser, 2015, pp. 9-13)

Value Stream Mapping strives to maximize value for customers by orchestrating an overall value creation process that reduces waste throughout design, construction, support, and maintenance. This approach consists of five key phases (Makhlouf & Hennion, 2017, pp. 112-113)

- Determine value from the perspective of the end customer.
- Identify value streams for each product category.
- Design the production flow.
- Implement production in response to customer demand (following the "pull" principle).
- Continuously pursue process management improvement towards excellence.

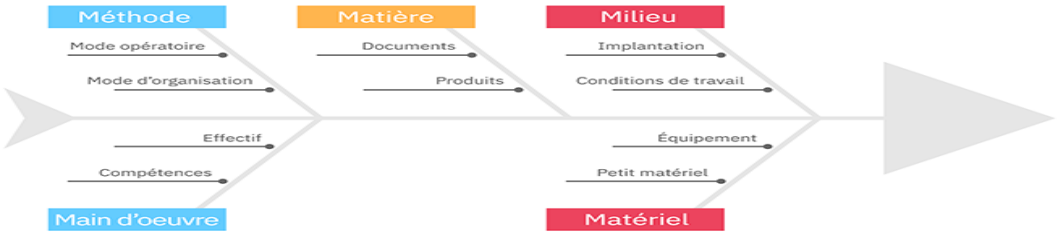
Figure 1 Product Value Creation Chain



Source: (Garnier, 2010, p. 21)

B. Ishikawa Diagram: The Ishikawa diagram, also known as the fishbone diagram, is a widely used visual tool in the professional environment to provide an overview of the root causes of a specific problem and its consequences. By systematically analyzing cause-and-effect relationships, the classification of causes allows for a precise identification of the origins of the problem. (Saeger & Feys, 2015, pp. 9-11)

Figure 2 Fishbone Ishikawa Diagram



Source: (Ribaudo, 2023)

Professor Ishikawa classified the various causes of a problem into five major categories known as the "5M": (Bouami, 2019, pp. 14-16)

Material: everything used or consumed in the project, such as raw materials, water, electricity, etc.

Environment: the environment and context likely to influence the project, such as the workplace or surrounding spaces.

Methods: encompassing existing procedures, information flow, research and development, operating procedures, etc.

Equipment or Machine: including all equipment necessary for the project, from premises to equipment, spare parts, technologies, etc., often requiring investments.

Manpower: representing the human resources involved in the project and their qualifications.

C. Pareto Principle: The Pareto Principle, proposed by Vilfredo Pareto, is based on an analysis and decision-making known as Pareto's Law. This law is based on the observation that twenty percent of the causes are often responsible for eighty percent of the effects. In the business context, this typically implies that 20% of customers generate 80% of sales. Identifying these key customers can enable businesses to save time and resources. It should be noted that the 80/20 ratio is not

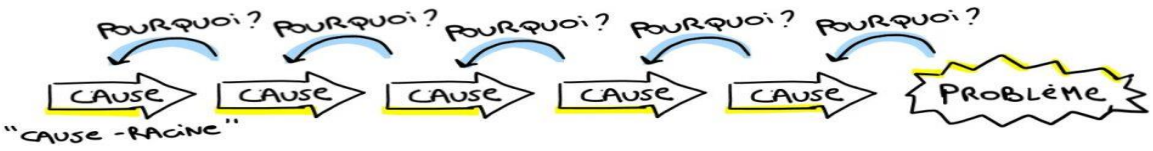
always precisely observed, but it offers insight into the reality and concentration of impacts. (Delers & Van Steenkiste, 2015, pp. 9-11)

There are numerous benefits to applying the Pareto Principle. A company's ability to understand the Pareto ratio for each department can improve its efficiency in several ways:

- **Risk Management:** By identifying the most significant and easiest-to-correct risks, the company can focus on its core activities, thereby improving its risk management.
- **Customer Insights:** Better understanding of customers allows the company to create targeted communication strategies for the most important customers. By understanding what characterizes the top 20% of customers, such as their origin, industry (for professionals), age, and gender, it is easier to target new prospects sharing these characteristics, thereby increasing conversion chances.
- **Expense Control:** The company can reduce expenses by adjusting, eliminating, or modifying costly items in its production chain.
- **Time Optimization:** Managers can focus on the most productive activities to improve efficiency. (Delers & Van Steenkiste, 2015, pp. 11-12)

D. The 5 Whys: The 5 Whys method, developed by Sakichi Toyoda, the founder of Toyota, is a problem-solving tool aimed at establishing cause-and-effect relationships. Based on the principle of repeatedly asking "why?", it seeks to clarify the root cause of the problem. This method involves gathering stakeholders, defining the problem, repeating the "why" question, and identifying the root cause. For a more in-depth analysis, it is recommended to combine the 5 Whys method with other tools such as the 5M. It is essential to note that one should not limit to five "whys" but continue to ask the question until the appropriate answer is found to effectively solve the problem. (Lagoda & Rosard, 2018, p. 56)

Figure 3 The 5 Whys method



Source: (Kuter, 2022)

Due to its effectiveness in sustainably and precisely resolving complex business problems, this approach is widely adopted in various problem-solving techniques such as Kaizen, Lean manufacturing, QQC, and Six Sigma, due to the following advantages: (Corbel, 2012, pp. 95-96)

- The 5 Whys method reveals deep-seated causes by iteratively tracing back to the roots of the problem by asking "why?". This allows for the identification of the true sources of the problem instead of merely focusing on apparent symptoms.
- It guides towards targeted actions by identifying the root cause of a problem, thus enabling direct action on the root cause rather than focusing on superficial effects.
- This method avoids ineffective or temporary corrective actions by focusing on the fundamental cause, thereby saving time and resources by directly applying solutions at the source of the problem.
- The simplicity and low resource demand of the 5 Whys method make it an accessible tool that can be used intuitively, resembling a natural method among young children, while also being reapplied by engineers for more formal analyses.
- Professionals can develop appropriate and effective action plans by understanding the root causes of problems, thereby promoting permanent resolution rather than temporary solutions.

Process analysis methods, designed to identify and resolve problems while promoting continuous improvement and operational optimization, are applicable to various sectors such as manufacturing, services, healthcare, and education. They enable the visualization of processes, identification of root causes of problems, prioritization of actions, and determination of the deep origins of problems.

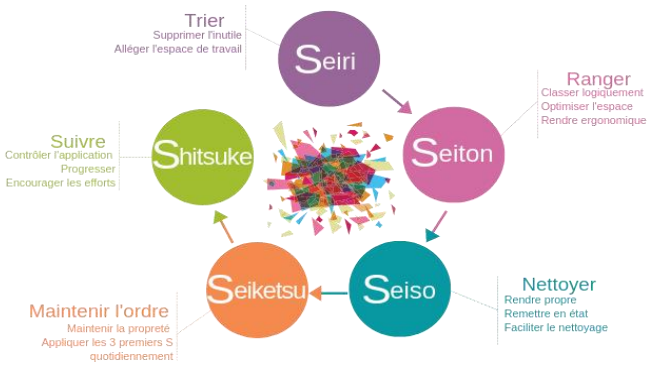
2.5.2. Production Process Optimization Methods

In this section, we examine production process optimization methods within the Lean approach, such as the 5S, SMED, Kanban, and Total Productive Maintenance. These tools play an essential role in improving operations within an organization.

A. 5S: The 5S involves the commitment and participation of members involved on the ground as well as the entire staff to improve existing processes. The "5S" method refers to five steps (Seiri, Seiton, Seiso, Seiketsu, Shitsuke) that begin with the letter "S" in Japanese. By focusing on these

five crucial actions to improve organization and process efficiency, this methodology, now known as "5S," aims to optimize operations.

Figure 4 The 5S Method



Source: (GRANGER, 2023)

The 5S, consisting of five steps (Seiri, Seiton, Seiso, Seiketsu, Shitsuke), is a methodology aimed at optimizing operational processes by encouraging a systematic approach to space and resource management (Dies & Vérilhac, 2017, pp. 69-70) :

- **Seiri (Sort/Selection):** involves selecting and eliminating surplus or non-essential items.
- **Seiton (Set in Order/Arrangement):** involves methodically organizing the remaining items after sorting so they are easily accessible and arranged in an orderly manner.
- **Seiso (Shine/Cleanliness):** encompasses regular and rigorous cleaning activities to maintain a clean and orderly work environment.
- **Seiketsu (Standardization):** aims to establish standards to maintain sorting, organization, and cleanliness practices.
- **Shitsuke (Sustain/Self-Discipline):** encourages the maintenance of established practices through personal and collective discipline.

The 5S offers numerous benefits and has a significant impact on various aspects of the business (Hohmann, 2010, pp. 35-40) :

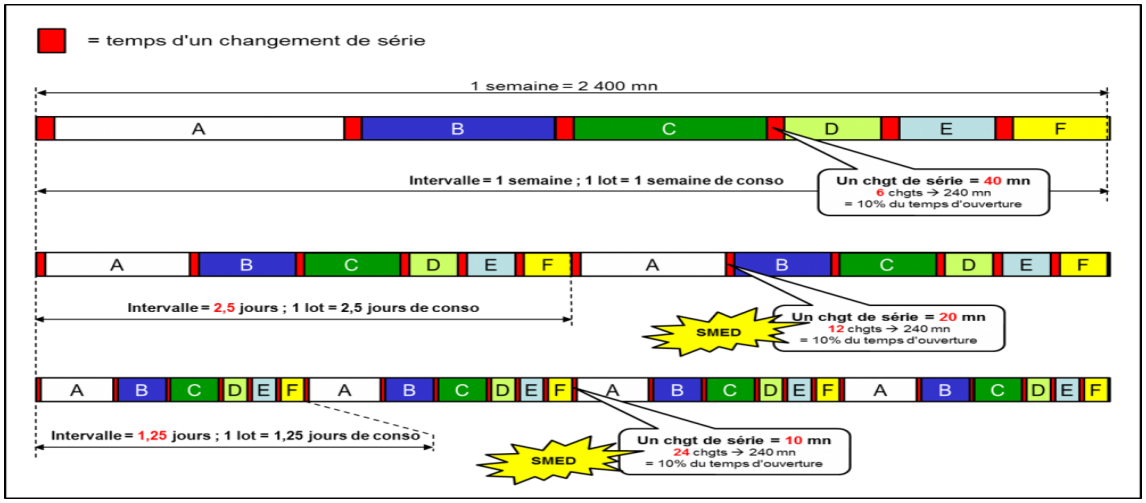
- **Quality:** The 5S promotes continuous improvement and efficiency, thus aligning practices with ISO 9001:2000 standards and the Six Sigma methodology.
- **Participation:** They encourage engagement and task diversification by involving employees in creating a suitable and safe work environment.

- **Brand Image:** The 5S contributes to a positive company image by establishing quality practices that influence customer perception.
- **Rule Establishment:** They facilitate the establishment of participative work rules, allowing performance to be measured and compared.
- **Employee Ownership:** Employee involvement in changes induced by the 5S reinforces their individual and collective responsibility.
- **Sustainable Development:** They align with companies' quality, safety, and environmental strategies, thus contributing to sustainability and an environmentally friendly culture.

These practices induce a profound cultural change that promotes respect, responsibility, and sustainability within the organization, while improving productivity and operational efficiency.

B. SMED (Single Minute Exchange of Die): The SMED, short for "Single Minute Exchange of Die," aims to reduce the time required to perform a tool change to less than ten minutes. Its primary goal is to minimize changeover times between the production of different products. This method aims to enable daily varied production by significantly reducing transition times between different manufacturing series, thus maintaining the company's competitiveness by being responsive and agile to production changes. The time required to make adjustments or changes, which can span several hours, has a significant impact on the company's economic performance. They affect the cost of products and, consequently, their selling price to the customer. (Dies & Vérilhac, 2017, pp. 92-94)

Figure 5 SMED Method



Source: (Leconte, 2008, p. 15)

The challenges of SMED go beyond merely accelerating the pace of work for operators; they also aim to make the work environment more ergonomic by simplifying changeover operations, as indicated by (Leconte, 2008, pp. 3-10) :

- **Stock Reduction:** SMED enables rapid production changes, allowing series to be adapted to customer demand without increasing costs. Stock reduction leads to reduced delivery times, as products are no longer waiting in the workshop.
- **Increase in Machine Uptime:** Machine downtimes, including series changes, setups, and preventive maintenance, have a significant impact on the company's economic efficiency.
- **Safety and Ergonomics:** By reducing downtime, SMED identifies potential causes of accidents related to unsuitable tools or dangerous postures, contributing to improved safety and ergonomics.
- **Product Quality:** SMED aims to establish reliable settings to ensure high-quality products from the first attempt, thus reducing setup times and waste. This reduces the need for redundant checks and the risk of delivering defective products.
- **Employee Training:** Excessive setup time can often be attributed to a lack of staff training. SMED highlights this gap and emphasizes adequate staff training to optimize operations.

Regarding the stages of tool change: (Leconte, 2008, pp. 15-17)

- Preparation and Verification: Ensure the presence and optimal condition of all elements necessary for the tool change.
- Assembly and Disassembly: Install the equipment necessary for the current series and remove those from the previous series.
- Alignment, Positioning, and Adjustment: Adjust tools and parameters to ensure optimal operation.
- Testing and Adjustments: Verify and adjust settings if necessary.

It is important to note that internal operations should be performed when the machine is stopped, while external operations can be carried out during machine operation. This approach optimizes time and increases the efficiency of tool change processes.

C. Kanban: The concept of "Kanban," introduced by Shigeo Shingō in the assembly and machining workshops of the Toyota factory in 1953, relies on the use of a production scheduling

system that uses cards or a simple visual system. The book titled "Production Mastery and Kanban Method - the Toyota Case" describes in detail the use of this tool. Its goal is to regulate flows by pulling production according to needs. (René & De Graeve, 2021, p. 74)

Kanban is a production organization method based on the use of simple cards or diagrams. Mainly used in Lean Manufacturing, it allows for the direct management of production flows. The process involves regularly supplying downstream workstations (customers) and calling upstream workstations (suppliers) through an exchange of labels. Kanban is not limited to simple information communication, it also ensures compliance with production and transportation deadlines, thus improving product traceability. (Rabia, 2016, pp. 49-50)

Figure 6 Kanban Board

Source: (Paquet, 2017)

In production, the Kanban system facilitates the transition from a push flow to a pull flow. In a push flow, production is often maximized without consideration of the needs of subsequent steps, leading to significant stocks of items in process. In contrast, in a pull flow, each step produces only what is necessary for the next step, in response to the direct demand of its customer, until the final order: (René & De Graeve, 2021, p. 75)

- Just-in-Time reduces waiting times and stocks. When the process is balanced, transit time approaches the sum of the times required for each step.
- In a push flow, the emphasis is on maximum production without considering the needs of the following or final customer. This can lead to stocks of items in production or waiting times for customers.
- In a pull flow, production starts only when the customer, whether direct or final, makes the demand. Waiting times occur when steps adjust their pace to the longest cycle time, often that of the bottleneck, leading to periods of internal inactivity.

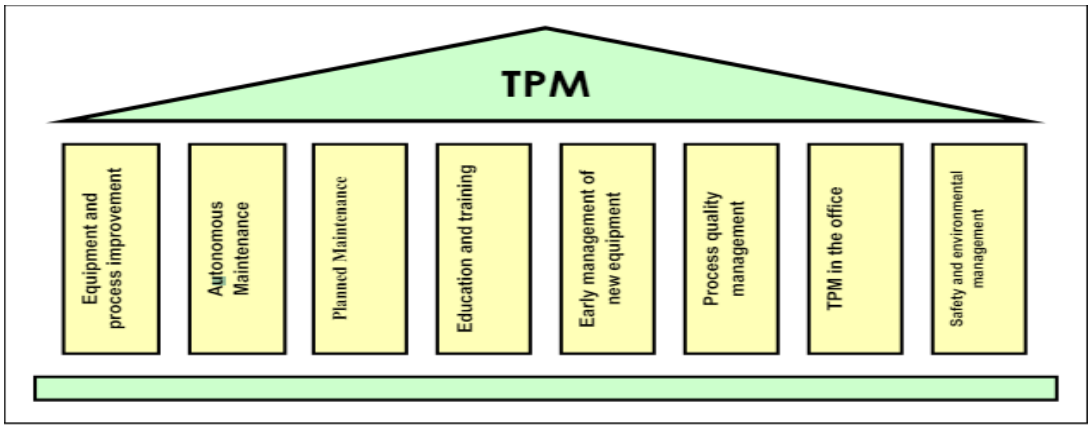
The advantages of the Kanban system are numerous (Lyonnet, 2015, p. 33)

- Kanban Promotes production focused on the pull flow by allowing suppliers and consumers to effectively control stocks.
- Accelerates the identification of hidden problems and ensures better quality throughout the process.
- Kanban calculation is a crucial decision-making tool as it allows for gradual adaptation of plans, initially with a high number of Kanbans, then with process improvement.
- The Kanban system is economical, using few material resources and not requiring significant investments.

D. Total Productive Maintenance (TPM): Total Productive Maintenance (TPM) was introduced in Japan in the 1970s. At that time, the Japan Institute of Plant Maintenance (JIPM), an organization specializing in industrial maintenance training and consultancy, played a key role in advising companies on adopting preventive maintenance methods developed by American practitioners. (Bufferne, 2011, p. 4)

TPM is a holistic approach aimed at continuously improving production resources to optimize the economic performance of businesses. These resources include not only equipment but also employees, especially those in production and maintenance departments, as well as the entire organization. TPM encompasses all personnel in functional services, providing the means and information necessary for production, while identifying and resolving potential constraints. (Bufferne, 2011, pp. 3-4)

Figure 7 TPM Pillars



Source: (RODRIGUES & HATAKEYAMA, 2006)

The TPM strategy is based on two fundamental elements: (Bufferne, 2011, pp. 11-12)

- It is crucial to stabilize the current production system to make it optimal. This involves maintaining normal operating conditions and restoring equipment to its original state while adhering to operational and maintenance standards.
- Once this stabilization phase is achieved, the company can focus on continuously improving the system to create ideal conditions for optimal industrial performance.

The advantages of TPM for the organization are manifold: (Dies & Vérilhac, 2017, pp. 87-90)

- Optimization of the environment and work methods.
- Promotion of operator autonomy and enhancement of their role on machines, while maintaining their good condition.
- Increase in machine efficiency (Overall Equipment Effectiveness).
- Reduction of maintenance costs.
- Ensuring a quick return on investment.
- Reduction of emergency situations.
- Elimination of problems and defective products.

These optimization methods aim to reduce waste, optimize flows, and ensure equipment reliability. They can be applied in various industrial sectors, including manufacturing, logistics, services, and even office environments. They are particularly effective where there are repetitive processes or operations prone to downtime, delays, or quality defects.

2.5.3. Continuous Improvement Methods

In their relentless pursuit of process improvement and optimization, organizations are increasingly turning to continuous improvement methods, rooted in the Lean approach. These methods are essential tools for achieving operational excellence. In this section, we will examine Continuous Improvement Methods within the framework of the Lean approach, highlighting Six Sigma and PDCA.

A. Six Sigma: The Six Sigma methodology represents a disruptive organizational approach that employs statistical tools to monitor and improve production processes. All elements of a problem-solving method are integrated into its DMAIC model (Define, Measure, Analyze,

Innovate/Improve, Control/Master), thus offering unparalleled efficiency and performance during its implementation. (Brulebois, Perrenot, & Saintvoirin, 2009, p. 19)

Figure 8 Six sigmas (DMAIC)

Source: (Fernandez, 2021)

The Six Sigma methodology is distinguished by its various components, as emphasized by (Makhlouf & Hennion, 2017, p. 31)

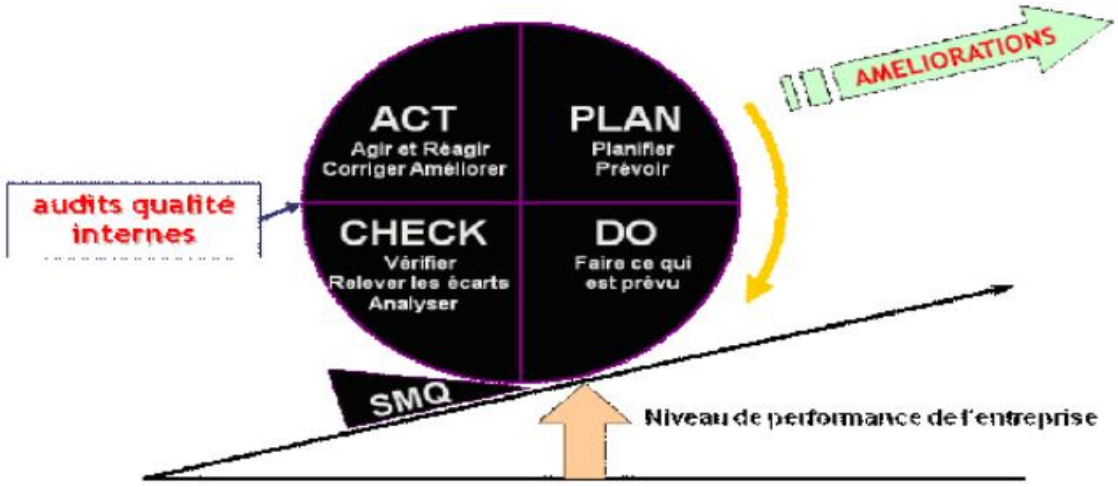
- A strategic aspect aimed at gaining a competitive advantage.
- A cultural dimension focused on continuous improvement.
- Sigma (σ), a statistical dimension representing statistical dispersion or standard deviation, measuring the variability of a process relative to its average. This parameter evaluates the performance of a process and estimates the probability of producing defects. Achieving Six Sigma is equivalent to a standard level of excellence where only 3.4 defects are present per million pieces or services produced by the process (DPMO, defects per million opportunities).

The Six Sigma method differs from other quality standards such as ISO 9000, QS-9000, as well as military standards 105 D and 105 E, by focusing on optimization. While these traditional standards focus on measurement, prevention, documentation, control, and improvement, Six Sigma integrates these aspects while specifically focusing on optimization. Statistical data reveals that a process controlled and optimized according to Six Sigma does not produce more than 4 defects per million units (3.4 PPM). There is, therefore, significant potential for improvement, as many companies operated at production levels between 3 Sigma (66,807 PPM) and 4 Sigma (6,210 PPM) in 1998, resulting in revenue losses of approximately 10 to 15% due to defective quality of their products and services. Many large North American companies are also adopting Six Sigma, thus exerting increased pressure on their suppliers and subcontractors. Indeed, for a process or

method controlled and optimized according to Six Sigma to be profitable, all its stakeholders must also be. Consequently, many suppliers strongly encourage their own suppliers to adopt Six Sigma and use information about this methodology to select suppliers whose processes are mastered. For a supplier using Six Sigma, this means offering superior quality products, ensuring a reliable production system, and engaging in continuous improvement to reduce procurement expenses. By emphasizing their unique skills, improving their logistical processes, and collaborating with specialized suppliers, major customers can design new products and processes while maintaining quality through Six Sigma. (AMOKRANE, 2011, pp. 148-150)

B. Le PDCA: B. PDCA: PDCA, or Plan-Do-Check-Act, constitutes a quality improvement method also known as the "Deming Wheel," conceptualized in the 1950s. This process is structured into four distinct steps: Plan, Do, Check, and Act. These steps, as described by (Giraud, Johnson, & Autissier, 2015, p. 104), define the phases to follow to drive the wheel towards continuous improvement, thus embodying the fundamental principles of continuous improvement of organizational processes.

Figure 9 PDCA (cycle of Deming)



Source: (Bouaziz, Besbes, & Attia, 2012, p. 05)

The PDCA, or Plan-Do-Check-Act, is an essential improvement process for businesses, as described by (Thibaudon & Chardonnet, 2014, p. 27), Each letter of the acronym represents a specific step:

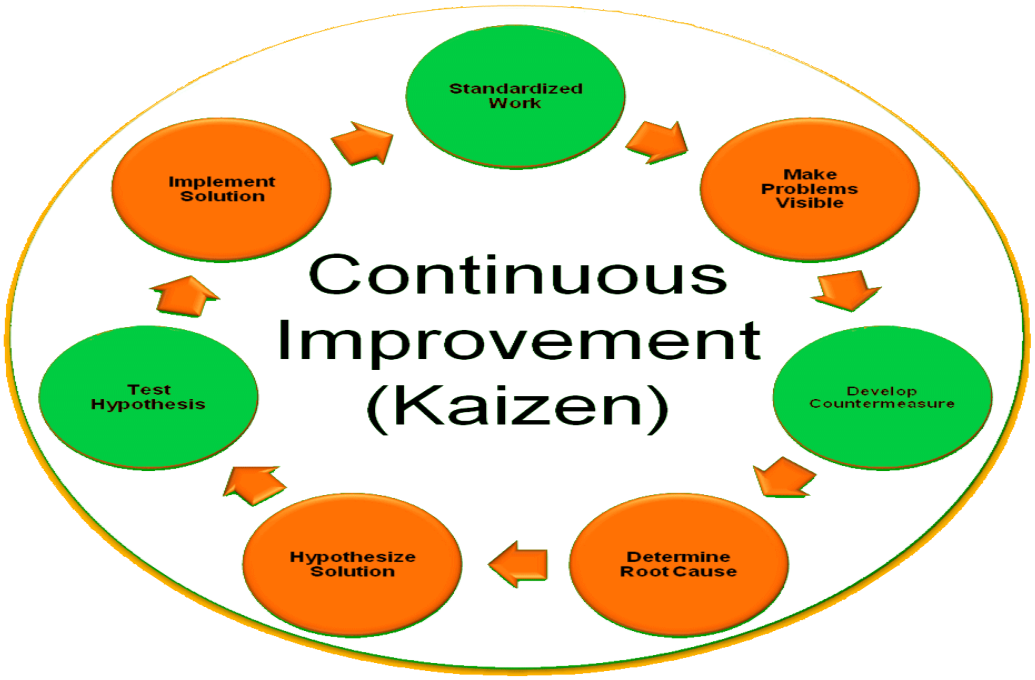
- "P" for Plan: This phase involves reflection and data collection prior to action. It is often associated with terms such as preparing, projecting, programming, foreseeing, or preventing.
- "D" for Deploy: To better highlight the managerial nature of the "DO" phase, this step is called "Deploy," thus emphasizing the concrete and collective aspect of action development in the field.
- "C" for Comprehend: We have opted to translate "CHECK" as "Comprehend" to preserve the original intent and avoid a simple interpretation as ordinary control. This phase requires measured analysis and a deep understanding of the results and methods that led to these results.
- "A" for Act: Translating "ACT" as "Improve" expresses the need to act based on the results and observed variances, thus promoting appropriate adjustments and the formulation of new objectives.

It is important to emphasize that PDCA is not merely a tool but represents a fundamental practice for continuous improvement in businesses. However, it is often misused for two main reasons. Firstly, it is often misunderstood: it is not a sequence of mechanical steps but rather a process requiring deep reflection. Secondly, the conditions for its success are often misunderstood. For example, PDCA is more effective when implemented as a team, as this promotes the integration of various perspectives and a better definition of the problems to be solved. Experienced companies in this field recognize the importance of these conditions for ensuring the success of PDCA. They acknowledge that reality is often complex to grasp objectively, as perception is subjective. Thus, the confrontation of different perspectives allows for a better understanding of the problems to be solved. Moreover, they are aware that the solutions developed must stem from the work of individuals directly involved, thus reinforcing their long-term impact. Finally, they recognize the importance of bringing together various intelligences and skills to succeed in this quest for continuous improvement. (Arosio, 2020, pp. 98-99)

C. Kaizen: Kaizen, an approach widely adopted in manufacturing processes for continuous improvement, derives its name from the combination of the Japanese terms "Kai," meaning "change," and "Zen," meaning "better." Fundamentally, this method relies on constant adaptation of existing tools and procedures to enhance the final output. Kaizen transcends mere

methodological frameworks to embody a mindset demanding active participation from all personnel, whether employees or managers. This approach integrates various tools, including PDCA, TQM (Total Quality Management), and SMED (Single Minute Exchange of Die), to achieve its goals. Unlike Western systems, which often prioritize major innovations, Kaizen focuses on small incremental improvements. These incremental changes do not require substantial investments. Rooted in Japanese corporate culture, Kaizen encourages every member of the organization, from top executives to workers, to engage in a perpetual quest for improvement. This philosophy has been a crucial element of Toyota's success, contributing to its global reputation. (Delers & Feys, 2015, pp. 11-12)

Figure 10 the Kaizen method



Source: (Mike, 2012)

The potential benefits of a Kaizen approach are manifold, as highlighted by (Charles, 2021, p. 27)

- Streamlining workflow: This encompasses productivity improvement, space optimization, and enhanced safety.
- Reduction of costs related to non-quality and customer satisfaction.
- Reduction of lead times, including inventory reduction and database optimization.
- Optimization of working conditions, including comfort, safety, and problem reduction.

Kaizen primarily manifests through two perspectives: on one hand, problem-solving to restore the normal situation, and on the other hand, continuous analysis of processes to enhance these standards. Toyota encourages deep reflection and constant improvements by establishing a link between problem-solving and standards. It's crucial to acknowledge that in Kaizen, the process itself holds as much importance as the received outcome. Additionally, Kaizen aims to consolidate human capital (knowledge and skills) as well as social capital (relationships and trust) within the company. However, without tangible improvements, the process risks losing its effectiveness, and the associated positive energy may dissipate. Thus, maintaining a balance between process and outcome is essential (Ballé, Jones, & Chaize, 2018, p. 57)

In conclusion, each Lean method has its own advantages, applications, specific tools, as well as distinct scope and complexity. Their combined use can offer more comprehensive results tailored to the specific needs of an organization. These methods exist to address the varied challenges encountered in an ever-evolving business environment. By choosing them wisely and integrating them coherently into a comprehensive approach, the implementation of Lean management methods provides a structured framework for continuous improvement of organizational processes. Value stream mapping, Ishikawa Diagram, Pareto principle, 5 Whys, 5S, SMED, Kanban, TPM, and other continuous improvement methods contribute to developing a culture of operational excellence and continuous innovation, thus strengthening the long-term competitiveness of organizations.

3. Section 03: Operational Performance

Operational performance is an essential concept for any business seeking to optimize its processes and achieve excellence. This section aims to establish a thorough understanding of this crucial concept. We will begin by defining operational performance and exploring various tools for measuring it accurately. Next, we will examine the key criteria that define a high-performing organization operationally. These criteria will serve as benchmarks for evaluating the effectiveness of existing processes and identifying areas requiring improvement. Finally, we will highlight the close relationship between Lean practices, a philosophy aimed at eliminating waste, and the attainment of optimal operational performance.

3.1. Definitions of Operational Performance

Due to its importance for individuals and organizations, operational performance has attracted the attention of researchers and academic institutions in many fields, as evidenced by the various definitions provided below:

According to (Mei, Milé, & Danny, 2008) , operational performance encompasses the results of organizations' internal operations, including aspects such as productivity, product quality, and customer satisfaction.

Tulkens (2007) defines operational performance as the degree to which a company operates near the limit of its production set. (Aude & Hervé, 2007, p. 06)

Miller and Brimley describe operational performance as how a company uses its human and material resources to achieve its goals, based on various competitive priorities such as cost reduction, delivery speed, and flexibility. (Belouadah & Djellouli, 2020, p. 182)

According to Heizer, operational performance refers to a company's ability to reduce management costs, order lead times, production lead times, optimize raw material utilization, and distribution capacity. (Huy Quang & al, 2017, p. 90)

(Louzani & Admane, 2021, p. 470), define operational performance as the organization's ability to produce and deliver its products more efficiently to customers, with increased quality and shortened delivery times, thereby strengthening its market position and increasing international sales opportunities.

(Bouabdallah & Abdelkader, 2020, p. 239) decompose operational performance into three evaluative criteria:

- Economy, which involves performing tasks at the lowest cost using available material and human resources.
- Effectiveness, involving achieving objectives at minimal cost by maximizing results and outputs with the same resources, or by reducing inputs while maintaining the same specified outputs.
- Efficiency, which entails achieving set goals for programs and activities.

Through these various definitions and perspectives on operational performance, it is evident that it manifests as a company's ability to efficiently exploit its material and human resources to manufacture and deliver superior-quality products to its clientele. This process involves cost and lead time reduction, as well as overall improvement in customer satisfaction.

3.2. Operational Performance Measuring Tools

To effectively manage a company's operational performance, it is essential to have reliable tools for collecting, analyzing, and visualizing relevant data. This section will focus on the primary tools used to measure operational performance. First, we will examine dashboards and performance reports, which offer a synthesized view of key indicators. These tools enable managers to quickly track the progress of strategic and operational objectives. Next, we will discuss Key Performance Indicator (KPI) tracking systems, which provide detailed and real-time data on specific aspects of operations. These systems facilitate in-depth analysis of bottlenecks, inefficiencies, and improvement opportunities. Finally, we will explore the role of Enterprise Resource Planning (ERP) systems in performance measurement. These integrated software solutions collect and centralize data from various sources, providing a 360-degree view of a company's operations.

3.2.1. Dashboards and Performance Reports

A dashboard is a set of indicators organized systematically and tracked by a team or specific manager to aid in decision-making, coordination, and control within a department. It is a communication and decision-making tool that allows the management controller to highlight essential aspects of management to the manager to optimize them (AMIFI & Abderrahim, 2020, p. 28).

It is crucial to distinguish between operational control indicators and reporting indicators. Operational control indicators are used to track action plans necessary to achieve results, while reporting indicators mainly focus on performance. Operational teams should use operational indicators more frequently than outcome indicators, which should be defined at the process level. They should not be contractually committed or subject to official reporting (Molho & Fernandez-Poisson, 2009, p. 116).

Characteristics of a dashboard include:

- User-friendly system that simplifies responsibilities;
- Facilitates short-term performance evaluation;
- Aids in decision-making;
- Aims for optimal resource utilization;
- Clarifies the company's situation and its environment;
- Indicates the extent to which actual activity corresponds to estimates;

- Allows immediate exploitation of information (Zineb & Reggad, 2021, p. 293).

Key Performance Indicator (KPI) & Tracking Systems: KPI tracking systems are based on significant elements or sets of meaningful information, representative indices, or targeted and contextualized statistics. These data stem from information collection on a state, observable manifestation of a phenomenon, or aspect of an organization's functioning (Kaouter & Morad, 2020, p. 357).

These systems are characterized by several aspects:

- **Alignment with strategy:** It is crucial for KPIs to be directly linked to business objectives. Otherwise, they may simply be operational or secondary measures, but not key performance indicators.
- **Ease of understanding:** Poor understanding of indicators can seriously affect productivity. KPIs should be easily understood by all relevant stakeholders.
- **Actionability:** It is essential for measures to be actionable, even indirectly. It is necessary to know how to act to influence KPIs.
- **Contextualization:** KPIs must be adaptable to set goals and thresholds. This approach is part of continuous optimization of interactive marketing. We recommend setting growth or decline objectives for each of the selected indicators at the beginning of the year. Thus, KPIs will help determine throughout the year how marketing activities will contribute to achieving these objectives. (Jacques, 2011, p. 06)

3.2.2. Enterprise Resource Planning (ERP) Systems

An ERP (Enterprise Resource Planning) system aims to merge a company's key management functions into a single computer system. In this framework, information flows automatically, synchronously, or asynchronously as required, and the system triggers necessary processes at the right time (Azan, 2002, p. 13).

According to APICS, an ERP is integrated software that ensures all of a company's activities are updated in real-time. It is linked to financial management and manages purchase, sale, stock, and resource planning orders (Bidan, 2006, p. 73).

An ERP system typically consists of four main areas: the first area concerns commercial management, the second area encompasses financial management, the third area focuses on human resource management, and the fourth area is dedicated to production management (M'hamed, 2022, p. 49).

It allows:

- Encompassing various aspects of company management, such as sales, accounting, payroll, inventory management, maintenance, suppliers, etc.
- Ensuring consistency of exchanged data by centralizing it on a single platform, thus promoting process standardization and improving customer relations through a dedicated tool (M'hamed, 2022, pp. 47-48).

3.3. ABC Analysis (Activity-Based Costing)

The Activity-Based Costing (ABC) cost calculation method aims to allocate costs to products or services by referring to the activities required to produce them. This method is based on identifying activities, the resources used by these activities, and cost drivers to determine more precisely the corresponding indirect costs (Dragoş, 2009, p. 06).

The basic elements of the ABC method (Activity-Based Costing) include: (Youcef, 2012, pp. 04-06)

- **Activities:** Defined as the set of elementary tasks carried out by an individual or a group to produce a result from homogeneous inputs from the perspective of their performance behaviors.

- **Cost drivers:** Explanatory factors of resource consumption by activities, used to allocate the value of activities to different cost objects.
- **Resources:** Of different natures, such as components, raw materials, information, or the use of equipment, distinguishing between permanent and consumable resources to assess the economic performance of activities.
- **Processes:** Playing an essential role in activity-based management, symbolizing the principle of cross-functionality and promoting collective work by encouraging the breakdown of departmental barriers.

The advantages of the ABC method include: (Bendaoud, 2013)

- Greater precision in cost allocation, allowing for a more accurate distribution of indirect costs and more reliable cost accounting.
- Better understanding of costs, by highlighting cost-generating activities to identify optimization levers.
- Informed decision-making, by providing precise information on product, service, or activity costs.
- Improvement in overall company performance, through better cost management and more relevant resource allocation.

3.3. Operational Performance Criteria

In this section, we present the criteria for operational performance, namely effectiveness, efficiency, objective, and relevance.

A. Effectiveness: Effectiveness can be defined as the extent to which defined objectives are effectively achieved, thus reflecting the accomplishment of what the policy or action was supposed to accomplish. (Australian Government, 2013, p. 06)

These objectives can vary in terms of specificity, ranging from very specific objectives to more general ones, thus forming a continuum. Effectiveness can also be understood as the achievement of expected objectives or results, implying that the organization succeeds in meeting its goals. In line with Drucker's philosophy, effectiveness involves "doing the right things," while efficiency lies in "doing things right". (Elfner, 1976, p. 05)

It is crucial to emphasize that even an extremely effective institution is not necessarily effective in all its actions.

Studies conducted so far to assess organizational effectiveness have identified various measures, which can be grouped as follows (2008 ,عبد الحميد, p. 62) :

Economic indicators: These measures are commonly used to assess the achievement of economic objectives within the organization, such as:

- **Profit growth rate:** (Current net profit - Previous net profit / Previous net profit) ×100%.
- **Sales volume:** gross or net sales figures over a given period.
- **Productivity:** measured in different ways depending on the sector and specific goals of the company. For example, in the manufacturing sector, by calculating the number of units produced per hour of work.
- **Return on investment (ROI):** (Net profit - Initial investment / Initial investment) ×100%.

Behavioral indicators: These indicators aim to achieve institutional objectives regarding the social aspects of employees and environmental management, such as:

- **Employee satisfaction rate:** measured using employee satisfaction surveys = (number of satisfied employees / total number of employees) ×100%.
- **Employee turnover rate:** (number of employees who left the company / total number of employees) ×100%.
- **Rate of participation in environmental initiatives:** (number of employees participating in these initiatives / total number of employees) ×100%.

Efficiency ratios: These ratios are specific to functional areas (production, marketing, finance, development, human resources), such as:

- **Labor yield ratio:** production achieved / hours worked.
- **Return on assets (ROA):** net profit / total assets.
- **Advertising ROI:** advertising cost / advertising revenue generated.
- **Conversion rate:** number of new customers / total number of prospects.
- Inventory turnover ratio: cost of goods sold / average inventory.

- **Project profitability ratio:** total costs of new projects / net profits of new projects.
- **Employee turnover ratio:** number of departures / total number of employees.
- **Employee productivity:** production achieved / number of employees.

B. Efficiency: Coelli, Rao, and Battese (1998) propose that efficiency is defined by a company's ability to optimize its performance using a defined set of inputs (Jayamaha & Mula, 2011, p. 02).

Efficiency is characterized by the ability to perform a task or produce a result without wasting materials, time, or energy, representing a level of quality or degree of technical efficiency. However, some ambiguity persists between these two terms, as efficiency also encompasses the ability to produce the desired result (Wilson & al, 2018, p. 267).

Since the concept of efficiency is inherently linked to cost and the relationship between inputs and outputs in the manufacturing or production process, a company's efficiency is evaluated by applying the following formula: (عبد الحميد, 2008, p. 57)

Efficiency = Value (or quantity) of outputs / Value (or quantity) of inputs

Types of Efficiency:

- **Productive efficiency:** It is measured using ratios such as the production ratio per unit of input, such as production per hour of work or per unit of invested capital. High productive efficiency means that an organization manages to produce maximum goods and services with given input quantities. This efficiency is achieved when the organization operates at the lowest point on the average cost curve, meaning it produces at the lowest possible cost per unit of production. In other words, it optimizes its input mix to maximize production while minimizing costs;
- **Technical efficiency:** It is measured by the ability to maximize production using available resources such as technology, labor, and capital to the fullest extent. This means producing as much as possible while minimizing the use of these resources. For example, an organization is considered technically efficient if it produces as many goods or services as it can using the least amount of labor and capital, without waste or excessive resource use. In other words, an organization is considered technically inefficient if it employs more personnel than necessary or uses more capital than required to achieve its production goals;
- **Economic efficiency:** It can be evaluated by comparing the total production cost of a good or service with its market value. Better economic efficiency often results in maximization

of surplus for both the consumer and the producer. It refers to the optimization of resource use to produce the most goods or services possible. This involves comparing different economic systems to assess their ability to provide goods and services using the least possible resources. Economic efficiency encompasses technical aspects, productivity, and prices, reflecting optimal use of available resources;

- **Allocative efficiency:** It focuses on the ability of productive institutions to optimally allocate available resources among different alternative uses, considering the costs and relative prices of these resources. This involves choosing the best combinations of goods or services using combinations of production elements, while considering the costs associated with their use. In other words, it aims to maximize economic welfare by optimizing resource allocations for the production of goods and services;
- **Fixed or static efficiency:** This form of efficiency concerns the evaluation of an organization's ability to optimize its production based on available resources, as well as technological and technical preferences. Static efficiency encompasses two main aspects: maximizing the production of goods and services considering allocated resources, and managing the size of different resources in the economy. These measures reflect consumer technical and technological choices, as well as the organization's ability to effectively integrate them into its production;
- **Administrative efficiency:** Administrative efficiency has been the subject of numerous previous studies due to its crucial role in the success of businesses and government agencies. It focuses on skills associated with efficient management and leadership, encompassing a variety of practices aimed at optimizing operations within an organization. Some experts argue that administrative efficiency is closely linked to the level of organizational development. For example, as a company evolves and becomes more complex, it inevitably requires more sophisticated administrative practices. Evaluating the efficiency of administrative practices can be done through various indicators such as process performance, employee satisfaction, and profitability. (Omar, 2023, pp. 3385-3386)

C. Flexibility: Operational flexibility refers to an organization's ability to adapt to challenges posed by changing environments while incorporating adjustments into its usual activities. This process requires an adaptable approach to meet customer needs in uncertain business or market contexts.

It encompasses the ability to meet demand while reducing transformation costs borne by the organization. This adaptation also includes responding to uncertainty, whether internal or external, by reactively or proactively adjusting operations to cope with changes. (Sarote & Cherian Samuel, 2021, p. 109)

Operational flexibility is now an essential skill sought by organizations as it enables them to react quickly and effectively to changes in their environment. In summary, it represents a company's ability to deal with uncertainty in its business environment in a proactive or reactive manner. This capacity includes several elements that may vary in importance depending on the needs and priorities of each organization. (ALLAM & al, 2019, p. 48)
Several types of flexibility have been identified:

Volume flexibility: This form of flexibility refers to a production system's ability to handle daily or weekly volume fluctuations of a product. Several approaches can be used to evaluate it:

- Historical data analysis on production volume variations to understand past trends and fluctuation patterns.
- Computer simulation to model different volume fluctuation scenarios and assess the system's ability to adapt to these changes.
- Interviews with production managers to understand the current capabilities of the system and gain their practical experience in managing volume fluctuations.

Product range flexibility: This form of flexibility evaluates a production system's ability to produce a variety of products without requiring major facility modifications. The following steps can be followed for its evaluation:

- Carefully examine the characteristics of production facilities to determine their suitability to support different types of products without requiring substantial changes.
- Analyze existing production processes to identify steps that can be adjusted or adapted to effectively accommodate a variety of products.
- Perform a detailed comparison with other similar production systems to evaluate the system's competitiveness in terms of its ability to produce a variety of products without major interruption of operations or additional investments.

Routing flexibility: This form of flexibility evaluates the ability to process a specific set of parts on multiple machines. Several methods can be used for its evaluation:

- Analysis of machine configuration and their suitability to process different types of parts.
- Evaluation of setup times and tool change times to ensure smooth transition between different sets of parts.
- Simulation of production flows to detect potential congestion points and assess the system's ability to reassign parts if necessary.

Operational flexibility: This form of flexibility primarily focuses on the ability to rearrange the order of operations. Several key aspects can be assessed to estimate this flexibility:

- Analysis of planning and scheduling processes to evaluate how easily and efficiently the order of operations can be adjusted as needed.
- Evaluation of personnel training and skills to determine their ability to quickly and effectively adapt to changes in the order of operations.
- Examination of change management policies and procedures to identify any potential barriers to operational flexibility and propose solutions to overcome them. (Magalhães, 2014, p. 05)

D. Objectives: Objectives: Operational objectives represent goals for continuous improvement, translating tactical objectives at an operational, short-term, and real-time level (HAMADMAD, 2017, p. 25).

The concept of objectives involves two interconnected concepts:

- Purpose, interpreted as the motivation, orientation, or tendency of an action, determines the types of problems a decision-maker must solve and describes the future state of a system from its initial state. It corresponds to the purpose of a company, reflecting the perception that a human group has of the system, although it is not directly operational (Mélèse).
- Goals, intentions motivating action over a generally indefinite time horizon, achieve purposes by guiding the execution of operational components. (HAMADMAD, 2017, p. 22)

According to the "SMART" method of defining an objective, it must possess the following characteristics:

- **Specific:** Clearly defined and precise for adequate understanding.
- **Measurable:** Quantifiable to evaluate its level of achievement.
- **Acceptable:** Accepted by all parties concerned.
- **Achievable:** Considering the capabilities of the system or entity involved.
- **Time-bound:** With a specified period for its achievement, divided into a precise timeline. (HAMADMAD, 2017, p. 23)

The company's objectives are often defined in its mission, vision, values, and strategic plans, varying depending on many factors such as the industry, the size of the company, its organizational culture, and its short and long-term priorities. Budgetary control plays a crucial role in achieving the operational objectives of the company in various ways, facilitating planning and monitoring of operational and investment expenses, ensuring effective cash-flow management, and establishing precise targets for the different departments of the organization (BERLAND, 1999, pp. 08-09)

By allowing "decentralization through control," budgetary control encourages objective-driven management and exception management, contributing to organizational success. Nevertheless, its effects on collaboration between managers, their stress levels, and the overall performance of the organization remain subject to debate. (Sponem, 2006, p. 02)

In summary, to ensure the validation, monitoring, and verification of objective attainment through management control and budgetary control, a rigorous process is indispensable. This includes the definition of SMART objectives, effective communication at all levels of the organization, the establishment of relevant performance indicators, analysis of corresponding data, corrective measures in case of deviation, transparent communication on progress made, and regular reassessment of objectives to ensure their relevance and alignment with organizational strategy.

E. Relevance: Relevance plays a crucial role in the long-term sustainability of any entity, being closely linked to the market's perception of the goods, services, and information it offers (Lusthaus & al, 2003, p. 113).

The stock market's reaction to information about a company particularly highlights its level of relevance.

Several indicators of relevance can be used to guide evaluation; however, many organizations overlook these indicators. Among these indicators are:

- Stakeholder satisfaction
- Number of new programs and services
- Change in attitude of partners
- Evolution of roles
- Change of funders
- Variation in reputation among similar organizations
- Acceptance of programs and services by stakeholders
- Allocation of resources for professional development
- Number of former and new funders (risk of funding interruption, obtaining grants)
- Change in the ability to innovate and adapt (adaptation to needs, methods of change). (Lusthaus & al, 2003, pp. 114-115)

3.4. The Link Between Lean Practices and Operational Performance

According to (Djezila & Nassim, 2022), the Lean philosophy focuses on optimizing performance in terms of productivity, quality, lead time, and costs, aiming to continuously improve these aspects by eliminating waste (Djezila & Nassim, 2022, p. 16).

Regardless of their size, companies must consider agility and efficiency in a context of constant change and the pursuit of performance. Therefore, adopting a Lean approach remains essential to achieve a level of operational excellence, which can be a determining factor for success if implemented correctly. In many sectors, Lean has become the primary language of operational excellence. (Djezila & Nassim, 2022, p. 23)

(Lamiaa, 2016), argues that the Lean system places great importance on product quality by eliminating waste. Unlike a symptomatic approach, Lean management focuses on eradicating the root causes of non-quality. Thus, adopting Lean Management allows an organization to significantly increase its productivity and improve various aspects of its operations. Indeed, Lean Management enhances the company's market responsiveness by enabling better capacity to handle urgent orders, quickly respond to market fluctuations, and more effectively meet needs while optimizing production planning and execution. These improvements result in reduced production

costs, notably by reducing upstream and downstream product stocks, leading to a decrease in the number of tasks required for stock management, handling, transportation, monitoring, and protection (Lamiaa, 2016, pp. 37-38).

Moreover, optimizing the production process maximizes the use of material and human resources while reducing defects and waste. The reduction of available space promotes a process reorganization to optimize activity organization, reduce non-essential tasks, and decrease work in progress. Consequently, local investments and equipment necessary for stock handling and holding are also reduced. This overall process optimization leads to a decrease in labor costs and an increase in employee satisfaction (Lamiaa, 2016, pp. 37-38).

According to Drew et al. (2004), the goal of Lean Management is to eliminate the root causes of poor organizational performance, especially in production, where companies are under constant pressure to improve efficiency and meet the cost, quality, and lead time requirements of a competitive market (ES-SADAT & DABNICHI, 2023, pp. 134-135).

As an effective approach, Lean Management aims to achieve operational excellence, reduce costs, improve product and service quality, and enhance innovation and customer satisfaction. The five key objectives of operational performance, namely quality, speed, reliability, flexibility, and cost, are closely linked, so that improvement in one can impact the others (ES-SADAT & DABNICHI, 2023, pp. 134-135).

According to (Mokline, 2019), adopting Lean Management methods can promote improvement in product and process quality, as well as an increase in the speed and reliability of operations, thus strengthening organizational flexibility and leading to significant cost reductions. These overall improvements in operations can have a positive impact on operational performance, a crucial aspect for achieving defined goals in a strategic plan. It is also emphasized that waste reduction and continuous improvement are essential priorities of Lean Management, aiming for more efficient resource management and optimization of operational processes. Therefore, by implementing Lean Management principles, companies can improve their operational performance by increasing efficiency, productivity, and competitiveness in the market. (Mokline, 2019, pp. 7-15)

It is clear, through various research, that there is a significant link between Lean Management practices and organizational operational performance. By focusing on optimizing performance in

continuous improvement of productivity, quality, lead time, and costs, Lean Management enables companies to increase their operational efficiency and agility to meet evolving market requirements. Lean Management principles, focused on waste reduction, allow more efficient use of resources and optimization of operational processes, resulting in improved efficiency, productivity, and market competitiveness. In summary, Lean Management practices play a crucial role in improving companies' operational performance, optimizing processes, reducing costs, improving quality, and organizational agility.

Chapter 02: Methodological Framework

The methodology encompasses the principles, procedures and practices that guide the research, while the research design refers to the plan put in place to explore the issue of interest. The methodology should be seen as covering the entire research process. (Marczyk, DeMatteo, & Festinger, 2010, p. 22)

This chapter presents the research methodology used to conduct this study, as well as the key elements that influenced the adoption of a mixed methodological approach. Arguments are presented to explain the selection of specific research methods used to collect and analyze the required data.

1. Section 01: Theoretical Model

This section of the chapter is dedicated to presenting the theoretical models used in our study. In this part, we will address the lean management practices evaluation model as well as the operational performance measurement model.

1.1. Evaluation of Lean Management Practices

Building on the theoretical foundations established in the first chapter, we have chosen to evaluate lean management practices by focusing on validating Lean management principles. This approach encompasses practices and methodologies aimed at assessing and optimizing operations within an organization. Our study focuses on measuring the impact of these principles on operational performance, particularly emphasizing key aspects of Lean management such as:

- Waste elimination (Muda)
- Just-in-time (JIT)
- Continuous flow (Jidoka)
- Continuous improvement (Kaizen)
- Respect for people
- Integrated quality (Poka-Yoke)

We selected this model for several reasons:

- It focuses on the influence of Lean management on the organization's operations and operational performance.
- It is applicable at all levels of the organization, with an emphasis on operations.

- It is supported by a solid base of research literature.
- It is applicable to a wide range of organizations.

1.2. Measurement of Operational Performance

To evaluate performance, we relied on specific aspects of operational performance, namely:

- Costs
- Quality
- Delivery
- Flexibility

The relevance of these aspects in the agri-food industry context, their perception of performance, their importance for businesses, as well as the balance they provide, were the main motivations behind their use in evaluating the operational performance of DEGLA EXPO.

2. Section 02: Methodological Approach

A study using mixed methods is a research approach that integrates both philosophical assumptions and survey techniques. These philosophical assumptions guide the collection and analysis of data, combining qualitative and quantitative data in the same study or series of studies. This approach is based on the idea that the combined use of quantitative and qualitative methods provides a deeper understanding of research issues than the exclusive use of either of these methods. (Nagels, 2022, p. 03)

In our study, our goal is to examine the nature of the relationship between lean management and operational performance and to evaluate how Lean management principles impact operational performance using qualitative and quantitative approaches (mixed method). We chose these methods to account for time constraints, the specificity of our research question, and the sample size. By using a qualitative approach, we seek to examine the relationship between these two main variables. By using a quantitative approach, we aim to examine the impact of the first variable (Lean management) on the second variable (operational performance) while maintaining methodological rigor appropriate to our investigative framework.

2.1. Epistemological Approach

Pragmatic epistemology is not in itself a methodology but rather a doctrine of meaning and a theory of truth. It is based on the argument that the meaning of an event can only be determined from experience. Emphasis is placed on the consequences and meanings of an action or event in a social context. (Morgan, 2014, p. 04)

The success of research requires a methodology, and being methodical involves first adopting an epistemological position. This epistemological position determines the underlying conception and vision of any research work, also indicating the chosen research paradigm. In this perspective, we opted for a pragmatic approach. Pragmatism, in summary, is a methodical strategy for solving problems that is closely related to research using mixed methods. It establishes a link between philosophy and methodology, often serving as neutral ground between the two.

2.2. Research Design

We conducted interviews with certain executives and senior managers of the studied organization to understand the reasons for choosing and applying the Lean management approach in the organization, instead of other management methods, as well as how it was implemented. We also sought to identify the objectives aimed at through its application, the difficulties encountered by the organization in achieving them, and some of the tangible results obtained since the beginning of its application, while exploring the relationship between this approach and the organization's operational performance.

A questionnaire was developed and distributed to the personnel of the concerned organization. Following data collection, a qualitative analysis was conducted to assess the relationship between the observed values of the independent variable, namely Lean management, and those of the dependent variable, operational performance. Additionally, a quantitative analysis was performed using IBM SPSS software to evaluate the impact of the independent variable, Lean management, on the dependent variable, operational performance. This approach allowed us to evaluate the results in relation to our research questions and hypotheses.

2.3. Variables

A variable represents a characteristic that can take different values, and it constitutes a logical categorization of attributes that describe the characteristics or qualities of an object (Kaur, 2013, p. 36)

In our study, we consider Lean management as the independent variable, while operational performance is treated as the dependent variable.

2.4. Study Population

The determining criterion in selecting our sample is to include individuals belonging to one of the four socio-professional categories (executives, senior managers, managers, staff) of Degla Expo, in order to address our research problem. Therefore, our study population is represented by the employees of Degla Expo, who embody and implement Lean management principles within this company, thus contributing to its performance.

2.5. Sampling

According to (Claude, 2019), sampling is a method used in surveys to select a representative sample of the studied population. Its main objective is to examine a specific portion of this population in order to draw conclusions that can be generalized to the entire population. In other words, sampling involves rigorously selecting individuals or specific groups to participate in interviews, focus groups, surveys, or questionnaires.

For our study, we used a convenience sample, selecting workers from the production and order preparation center (central management) of the company. This sample represents 10.5% of the company's workforce, which totals 600 employees. The calculation is as follows:

$$(63 \div 600) \times 100 = 10.5\%$$

In the context of our sampling and selection process for the qualitative study, we chose to conduct interviews with 5 individuals out of the 63 comprising our study sample. This number represents 7.93% of the study sample, calculated as follows:

$$5 \div 63 = 0.0793650794 = 7.93650794\%$$

These individuals were selected based on their position and role within the organization, including senior executives and managers, as well as based on their involvement in the organization's activities.

Table 1 List of Interviewees

Individuals	Interview Duration
Technical Director	30 mins
Finance and HR Director	40 mins
Quality Management Manager	20 mins
Production Manager	30 mins
Stocks Manager	20 mins

Source: elaborated by us

In our sampling process for the quantitative study, our sample consists of the remaining managers and workers, totaling 58 individuals out of the initial 63-sample. This number represents 92.06% of the study sample, calculated as follows:

58 ÷ 63 = 0.920634921 = 92.0634921%

We then chose a simple random sampling process to determine the required sample size, using the following formulaformula:$\mathbf{1+N\ (e^{2}) = 58/\ 1+58(0.052) \approx 50.13}$

Where:

- n is the sample size
- N is the population size (in our case, ...employees)
- e is the desired margin of error (0.05 for a 5% margin of error)

Thus, 50 questionnaires need to be completed to ensure the required statistical accuracy in our study.

3. Section 03: Data Collection Instruments

In this phase, our objective is to collect the necessary data to address our research question. To do this, we employed surveys as a method, using qualitative and quantitative investigation tools, mainly interviews and questionnaires. The choice of these tools was motivated by the sample size and the specificity of our research question, making them most suitable for our approach.

Interviews were conducted individually and face-to-face with the company's executives. These interviews included questions about goal selection, Lean management implementation, outcomes achieved, as well as obstacles encountered during its application in the organization.

The questionnaires, distributed to the company's employees, generally consisted of two types of questions: open-ended questions and closed-ended multiple-choice questions.

- Open-ended questions allowed participants to freely develop their responses in terms of form and length, although they are less quantifiable than closed-ended questions.
- Closed-ended questions demanded specific answers, thus limiting respondents' choices.

The questionnaire also included open-ended and closed-ended questions using the Likert scale as the measurement basis. Frequently used in surveys and questionnaires, the Likert scale is a tool intended to assess an individual's opinion on a particular subject. This measurement method offers a range of response options allowing each participant to express their level of satisfaction, agreement, or disagreement with a specific question. (Gadant, 2021)

3.1. Discussion of Results

Initially, the discussion of qualitative results relied on a qualitative analysis of grid indicators. Quantitative study variables were aggregated by calculating their frequencies and percentages, facilitating the implementation of a principal component analysis. This method allowed us to simultaneously deal with multiple variables.

3.2. Research Material

To conduct our research effectively, we utilized a variety of techniques. These included recording interviews using our smartphones and taking handwritten notes during interviews to record essential information. Additionally, we obtained participants' consent and ensured the confidentiality of the collected data in accordance with rigorous ethical standards.

For questionnaire administration, we used Microsoft Word and Microsoft Excel tools, which are part of the Microsoft Office suite. This choice was motivated by their availability, editing capabilities, and ease of data transfer to analysis software.

Quantitative data analysis was conducted using IBM SPSS software. This platform offers a wide range of advanced statistical analyses, a comprehensive library of machine learning algorithms, and text analysis functionalities. Moreover, its ability to handle large datasets and seamless integration into applications were crucial criteria in our selection. Our decision was based on the availability, mastery, and efficiency of this software.

3.3. Validity

In our research, we applied a validation method based on evaluating the application of Lean management principles, while measuring operational performance across various aspects of performance.

Chapter 3: Presentation of the host organization and discussion of results

This chapter explores in depth the EURL DEGLA EXPO. The first section focuses on a presentation of the company, including an analysis of its conceptual framework focused on lean management and operational performance. The second section presents and discusses the results of the study, thus offering an overview of the challenges, opportunities and recommendations for the continuous improvement of DEGLA EXPO towards operational excellence and customer satisfaction.

1. Section 01: Presentation of the host organization

1.1. DEGLA EXPO

DEGLA EXPO, founded in 2016, specializes in the production, packaging, and export of dates, with a focus on the famous Deglet Nour variety. Originally focused on the operation of family palm groves, DEGLA EXPO has significantly invested in creating a modern packaging unit. Although the initial results were promising, the company aspires to even greater success.

By combining tradition and innovation, DEGLA EXPO has adapted to the requirements of the international market, thus developing a wide range of products meeting the varied needs of its clientele spread across more than 10 countries on three continents: Europe, North America, and Asia. As a result, DEGLA EXPO is now ranked among the most successful SMEs in the agricultural sector in Algeria.

In 2022, DEGLA EXPO exported over 4000 tons of dates, illustrating its success on the international stage. However, aware of persistent challenges, the company remains committed to improving its performance and strengthening its position in the global market.

To achieve this, DEGLA EXPO is committed to continuing its efforts in innovation and quality, while consolidating its commercial partnerships and exploring new potential markets. By capitalizing on its strengths and remaining attentive to market needs, DEGLA EXPO is determined to reach new heights in the date industry, while preserving its family heritage and commitment to excellence.

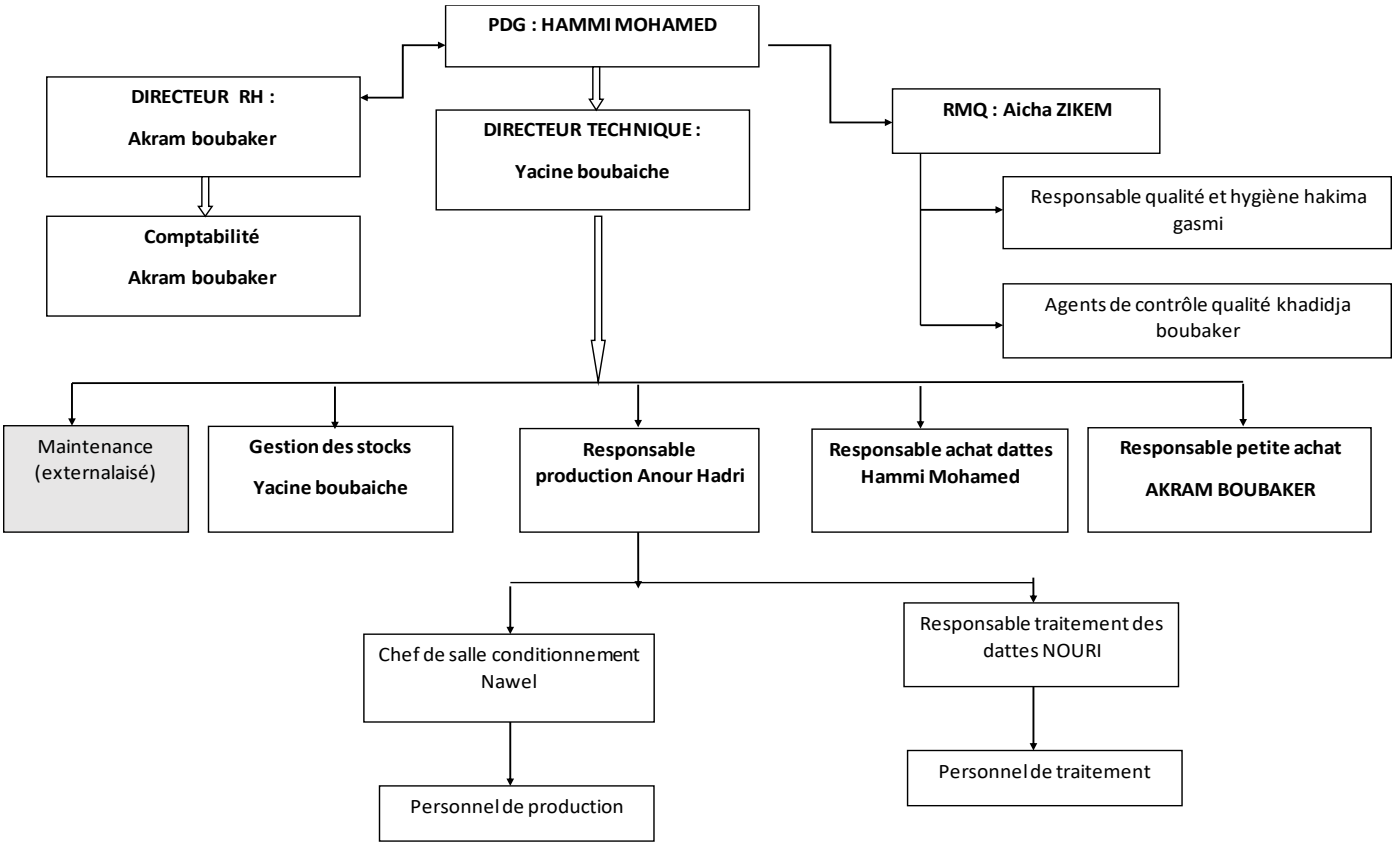
Table 2 Company Identification sheet

دقلة إكسبو DEGLA EXPO	
Year of creation	2016
Fonder	HAMMI Mohamed
Legal Form	natural person
Management	Director: HAMMI Mohamed
Staff	600

Source: Based on the company's identification form (provided by the company)

1.2. Organizational Chart

Figure 11 DEGLA EXPO Organizational Chart



Source: Documents provided by the company

The organizational chart presented for DEGLA EXPO is a conventional hierarchical diagram illustrating the company's pyramid structure, with the Director at the top and various subordinate departments. At the helm of the company is HAMMI Mohamed, serving as the Manager.

Here are the different departments and their respective heads:

- Human Resources Department: Akram BOUBAKER
- Technical Department: Yacine BOUBAICHE
- Accounting: Akram BOUBAKER

The production department includes:

- Production Manager: Anouar HADRI
- Date processing manager: Nouri
- Packaging hall supervisor: Nawel
- Production staff
- Processing staff

Other services included in the organizational chart are:

- Maintenance (outsourced)
- Stock management: Yacine BOUBAICHE
- Quality and Hygiene Manager: Hakima GASMI
- Quality control agents: Khadidja BOUBAKER
- Date purchasing manager: HAMMI Mohamed
- Small purchases manager: Akram BOUBAKER

1.3. Structure

DEGLA EXPO is composed of strategic operational entities geographically distributed to optimize its operational efficiency. These entities include collection, sorting, and pitting centers located in Boussaâda, Batna, and Mila. Additionally, the company's headquarters and its packaging and order preparation unit are located in Tolga.

Table 3 Degla Expo Entities

Entities	Location
Packaging and order preparation unit	Tolga, Biskra
01 Pitting centers	Mila
01 Pitting centers « Marouana »	Batna
03 Pitting and sorting centers « Ain Touta »	
01 sorting centers « Bensrour »	Boussaâda

Source: Documents provided by the company

This geographical structuring enables DEGLA EXPO to effectively cover the main date production areas in Algeria and centralize its packaging and order preparation operations at its headquarters.

1.4. Strategy

DEGLA EXPO's strategy aims to capitalize on the growth of the date production and export market by streamlining its activities to achieve resilient revenue and attractive value for all stakeholders. In a context marked by intense dynamics, increasingly demanding stakeholders, constantly evolving and strict legislation, as well as an increasingly educated and demanding consumer, DEGLA EXPO actively engages in a quality and food safety approach to address these challenges.

To this end, DEGLA EXPO has defined strategic axes, namely:

- Compliance with legal, regulatory, and contractual requirements regarding food safety.
- Seeking the best performance from its suppliers and establishing a strong partnership relationship with them.
- Promoting a culture of quality, awareness, and leadership within the company, focusing on education, training, supervision, and effective communication.
- Ensuring continuous improvement by analyzing gaps, implementing corrective and preventive actions, and monitoring their effectiveness.

DEGLA EXPO's management is committed to communicating this quality policy and objectives at all operational levels and providing the necessary resources (human, financial) to implement them and achieve the set quality objective.

1.5. Mission

The mission of DEGLA EXPO is to produce and pack delicious and healthy dates while maintaining integrity, kindness and respect in all its operations. The company is committed to consistently and sustainably delivering the highest quality product on the market, without compromising its core values. To achieve this goal, DEGLA EXPO ensures superior product quality at every stage of the process, from the selection of raw materials to the final packaging. By placing customer satisfaction at the top of its priorities, DEGLA EXPO adopts a customer-centric business model.

1.6. Vision

DEGLA EXPO's vision is to become a recognized leader in the date industry by offering superior quality products and exceeding the expectations of all stakeholders. To achieve this goal, the company is committed to building strong partnership relationships with its suppliers and promoting a culture of excellence and quality awareness at all levels of the organization. DEGLA EXPO also aims to ensure continuous improvement by analyzing deviations, implementing corrective actions and monitoring their effectiveness, in order to maintain high standards of food safety and product quality. In addition, the company undertakes to transparently communicate its quality policy and objectives to all levels of the organization, and to provide the necessary resources to achieve them.

1.7. Values

According to DEGLA EXPO, the company is firmly committed to the following values:

- Integrity: It is committed to the highest ethical standards in all its activities.
- Quality: Its goal is to provide products of the highest quality, while ensuring food safety and maintaining high performance standards.
- Collaboration: DEGLA EXPO seeks to build strong partnerships with its suppliers and stakeholders to achieve common goals.
- Commitment: The company is committed to continuously improving its processes and meeting the needs and expectations of its customers and society as a whole.

2. Section 02: Presentation and discussion of results

This section is dedicated to presenting the results of our study. We will examine the findings from the study and analyze them to address the research problem and hypotheses formulated.

2.1. Results of qualitative interviews

This part presents the results of our study on the impact of applying lean management principles on the operational performance of Degla Expo.

A. Section 01: Company's overview

This initial section presents the participants responses regarding the overview and specificities of their company.

Table 4 Representation of participants' responses regarding the overview and specificities of their company.

Individuals	**Questions**	**Answers**
Technical Director	Could you provide us with information about your company, its main sectors of activity, and its main strengths?	EURL DEGLA EXPO, founded in 2016, is a company specialized in the exploitation and export of dates. It stands out for the superior quality of its products, which comply with international standards such as FSSC22000, Kosher, Fisma and the European Organic Label. DEGLA EXPO offers a wide range of products, including natural, peeled, sliced dates and date pastes. The company is known for its strict compliance with hygiene standards, careful packaging, qualified staff and high customer satisfaction. Thanks to the efficiency of its management team and its workers, DEGLA EXPO has managed to integrate into the international market while offering excellent value for money.
Financial and HR Director		
production manager		
Quality management manager		
Stocks manager		
Technical Director	Speaking of strengths, could you also share your perspective on the company's main weaknesses?	Among the main weaknesses of our company, several aspects related to manpower and equipment can be identified. We see a lack of qualified staff, which leads to a high turnover rate and sometimes requires us to use unskilled employees. In addition, we face significant challenges in distribution and logistics management, as well as limited technology in some cases. Finally, illegal competition and the need to import modern equipment from abroad are also major obstacles to our development.
Financial and HR Director		
production manager		
Quality management manager		
Stocks manager		
Technical Director	Can you give us an overview of your company's activities and present both the local and global market in which you operate?	We operate exclusively in the international date market, focusing on export and avoiding the local market. Our products enjoy worldwide popularity, with a notable presence in the US market. We continually strive to expand our presence in global markets.
Financial and HR Director		
production manager		
Quality management manager		
Stocks manager		
Technical Director		We operate in a favorable but complex environment, marked by strong and fair competition due to the uniqueness of our raw material. However, this

Financial and HR Director *production manager* *Quality management manager* *Stocks manager*	How would you describe the environment in which your business operates? What are the main challenges you face?	environment presents many ongoing challenges, especially in the areas of production, distribution and organization. One of the major challenges is the lack of manpower and the need to maintain product quality while meeting customer requirements. In addition, we must adapt to a constantly changing market with multiple competitors. To preserve our competitiveness, we strive to certify our products according to international standards such as Bio Land, Bio Suisse, Bio Dynamie and Nature Land.
Technical Director *Financial and HR Director* *production manager* *Quality management manager* *Stocks manager*	What values do you consider most important for your company? How does your company communicate these values to its employees?	The core values of our company include integrity, respect, and commitment to quality. We place a strong emphasis on customer satisfaction, cleanliness, and discipline. To achieve these goals, we organize our administrative staff, recruit more qualified people, and ensure that we meet the quality standards and deadlines of our customers. We share these values with our staff through ongoing training and awareness, including monthly sessions, to ensure our employees embody these principles in all aspects of their work.
Technical Director *Financial and HR Director* *production manager* *Quality management manager* *Stocks manager*	Could you briefly describe your organization's objectives? How do you assess the success of your organization in meeting these goals? Questions	Our company is currently well-positioned according to market analysis, being certified in quality and hygiene standards, which is one of its major strengths. We have successfully penetrated the American and Canadian markets and always strive to work with markets of quality and excellence. Our goal is to continue to develop and excel, maintaining a stable growth rate. We focus on improving the quality of our products, expanding our presence in international markets, and increasing customer satisfaction. Customer satisfaction is paramount, with very few complaints, which reflects the quality of our products. We also seek to increase our production while maintaining and enhancing this quality, to further reduce customer complaints. By achieving these objectives, we aim to generate financial profits, create jobs, and provide high-quality food products. Answers

Source: elaborated by us

B. Section 02: evaluation of the application of lean management principles

This section presents the participants' responses regarding the evaluation of lean management principles within the company.

Table 5 Representation of participants' responses regarding the evaluation of lean management principles in the company

individuals	**Questions**	**answers**
technical director *Finance and HR Director* *production manager* *Quality management manager*	Can you explain what Lean Management means to you?	Compared to lean management in date export plants, it differs from other plants due to the uniqueness of our raw material. Working with a single raw material facilitates the application of lean management. The latter is particularly interesting for date export plants because it allows obtaining international quality certificates, which promotes market penetration. To reduce costs, we run the machines in parallel while maintaining production. We implement techniques such as root cause analysis and workplace organization to speed up the production chain. This approach

Stocks manager		helps our business by reducing time, effort and costs. I am convinced that reducing costs and storage times is crucial for the long-term success of any business.
technical director *Finance and HR Director* *production manager* *Quality management manager* *Stocks manager*	Let's talk about lean management. How do you think applying lean management principles can help your business?	When operating in international markets or within international companies, the organization plays a key role in ensuring an effective presence in quality markets. It is therefore imperative, in order to sell our products, to comply with these standards and implement lean management within the company. lean management can provide support through an approved programme. We use techniques such as root cause analysis and optimization of workplace organization and storage to speed up the production chain. This helps to improve our business in terms of reducing time, effort and costs. In my opinion, this is what determines the success or failure of any business, the ability to reduce costs and storage times. The most important principle is to produce at the lowest cost with the best quality.
technical director	Have you implemented lean management initiatives in your organization? If so, could you share some examples and results?	
	What criteria were used to select them?	We always seek to apply hygiene and quality standards because we always seek customer satisfaction and economic profitability among the studies, we have carried out economic profitability studies and fusibility technical and socially fair we currently recruit simple workers 5 middle management and 3 managers at our company level
	Why did you choose lean production management over another management method, and does your company use other management methods?	We much more chosen the methods that help us to apply the standards of quality and hygiene
	What problems does your company seek to solve by implementing lean production management?	For the moment there are two ways: lean management and stock management and among the strong points e lean management is team organization, supply chain, production chain and also to concretize the new international markets
Finance and HR Director	How does your organization integrate the principle of "creating value for the customer" into its activities?	Team organization, mastery of quality standards, and customer specifications must be applied 100% to avoid the problem of refusal of centenarians
	What budget approach do you use for continuous improvement within your organization?	By providing high quality products compared to other companies in the market.
	Can you provide information on the composition of the company's current workforce?	We follow a flexible budget that allocates resources according to needs and priorities, while focusing on achieving business goals and improving efficiency.
	What personnel development programs have been implemented to improve operational performance?	Staff mix includes the number of employees and their distribution across departments, as well as the skills and expertise required to achieve the company's objectives.
	What policies and practices are adopted for employee performance management?	We offer various training programs and workshops to develop employee skills and capabilities, including training on lean production management and operational performance improvement.
	How are employees involved in the implementation of lean management	We use an integrated employee performance management system that includes goal setting, performance evaluation and feedback to improve performance.

	methods and what training is provided in this regard?	
	How do you encourage employees to take a continuous improvement approach?	Practical training in the application of methods in daily work and old rewards and recognitions for employees who actively contribute to process improvement.
	What methods are used to encourage employees to apply these continuous improvement approaches?	We encourage employees to participate in continuous improvement processes by offering rewards and recognition for innovative ideas and effective improvements.
production manager	What techniques are used to minimize variations in the production chain?	We use a variety of methods to motivate employees, including financial and non-financial incentives such as promotions, public recognition and work-life balance
	What is the current state of production in relation to the planned objectives?	One of the main challenges we face is increasing demand, and we use strategies such as improving supply chain planning and organization to deal with it.
	What are the main production challenges you face and what strategies are used to overcome them?	We develop productivity improvement plans that include optimizing production processes to increase efficiency.
	What are the approved productivity improvement plans?	Fluctuations in global demand pose a challenge for Degla Expo. An increase in demand can overload production, while a decrease can cause over-storage and increased costs. Maintaining quality and optimizing costs requires constant monitoring and optimization of production processes. Careful coordination with suppliers is essential to optimize the supply chain.
Quality management manager	How do you integrate Lean principles into operations?	We develop and implement improved processes and try to modernize technologies and equipment to increase production efficiency.
	Where is the self-control and control of operators?	Organize and clean the workplace, inspect finished and semi-finished products.
	How do you manage cycles of non-compliance and continuous improvement?	Self-control in the middle of the production line. Control by operators: at the end of the production line.
	What quality control processes are in place?	Applying HACCP and 5 M
	How do you use feedback to improve product quality? What Lean practices are used in this process?	Monitor the finished and semi-finished product and raw material, ensure the cleanliness of the workplace, the cleanliness of workers, and avoid allergens.
	How can transport processes be improved to reduce unnecessary travel?	By training and improving workers from time to time, a preliminary and written questionnaire is then established. This way, we know if the worker is able to monitor and correct errors.
	What strategies do you follow to ensure stock availability by working with suppliers?	The application of these principles reduces movement in storage areas.
	What are the main inventory management challenges you face and what steps are you taking to overcome them?	The date that orders from the supplier are placed after completing an export order group.

Source: elaborated by us

C. Section 03: Measuring the impact of lean management principles on the company's operational performance

This section presents the answers of the participants concerning the measurement of the impact of lean management principles on the operational performance of the company.

Table 6 Representation of participants' responses regarding the measurement of the impact of lean management principles on the operational performance of the company

Individuals	**Questions**	**Answers**
technical director	How was progress assessed after the implementation of lean management and which performance indicators were used in this evaluation?	Among the indicators to use: customer satisfaction in terms of quality of our product, operating time, and the price because we worked in the Tolga regions there are more than 15 factories and we worked on the same product in the same market so tried to master variable loads and fixed loads.
Financial and HR	Can you give us an overview of your company's current financial situation? How do you assess it?	The current financial situation of a company refers to the ability to meet financial objectives and the continuity of operations. We assess the financial situation by analyzing monthly and quarterly financial reports and identifying any issues or discrepancies in financial performance.
	What are the short- and long-term financial projections for the company? Can you provide an estimate of the percentage needed to achieve these projections?	The short- and long-term financial outlook foresees increased revenues while optimizing the cost structure and maintaining profitability. Financial forecasts are based on analysis of past trends and current market conditions.
	How does your organization use financial data to make strategic and operational decisions?	We use financial data to make decisions: We use financial data to estimate financial needs, provide guidance on costs and investments, analyze return on investment and make strategic decisions to achieve objectives.
	How to assess the profitability of your company?	The assessment of our company's profitability is done by controlling revenues and expenses and calculating net profits. Financial indicators such as net income/revenue can also be used to assess financial performance.
	What are the main financial indicators you use to assess your company's operational performance?	The key financial indicators we track include total income, variable costs, net income, net income/sales, liquidity ratio and return on investment.
	What financial impacts do you expect from waste reduction in your organization?	Save money on costs to satisfy customers at competitive prices compared to other companies.
	Can you describe your company's cost structure and its impact on profitability?	The cost structure includes all costs related to the production and distribution of products, including raw materials, labor, marketing and operating costs. Their impact on profitability depends on how they are managed and controlled, as rising costs can affect profitability if they are not well controlled.
	What are the main operational costs your company faces and how do you see their evolution before and after the implementation of "lean management"? How do you rate this change	Labor and raw material costs are the main operational costs we face, but we are constantly improving by recruiting skilled labor.
	How do you assess the effectiveness of your recruitment and retention processes, for example in percentage terms?	We assess the effectiveness of our recruitment and retention processes by monitoring employee retention, recruitment rates, employee satisfaction and analyzing the reasons for transfers.
production manager	How did production schedules change before and after the adoption of lean management principles?	The time required to complete orders has been reduced and delivery times have been optimized.

	How have working hours changed before and after the implementation of lean management principles?	The work became more efficient and overtime was reduced to a minimum.
	How did the amount of labor produce change before and after the implementation of lean management principles?	Labor productivity increased by almost 50% compared to the previous year.
	What changes have occurred in production standards before and after the implementation of lean production management principles? Can you give an example?	Before the implementation of the Lean principles, there were significant variations in processes, but after the implementation, we found a significant improvement in efficiency and a reduction in variations.
	How has the amount of production waste and waste changed before and after the implementation of Lean principles? Can you provide a percentage estimate?	Waste and wastage were high, but after implementation we saw a reduction of more than 20%.
Quality management manager	From your point of view, how has the use of Lean management methods contributed to reducing the number of final checks and quality non-conformities?	Help to facilitate work in terms of reducing delays, praise and costs, as the number of inspections has decreased and cases of inadequacy are almost non-existent.
	What indicators are used to measure the quality of a company's products or services? Can you give a rating on a scale of 1 to 10?	Control of the final product (water and moisture activity, microbial analysis on plate, monitoring of the percentage of viable and viable weevils...) Control of the cleanliness of cartons, markings and packaging. 08/10
	Have customer satisfaction surveys been conducted? How do you assess customer satisfaction before and after implementing Lean Management on a scale of 1 to 10?	Yes, 9/10
	How did the customer portfolio evolve before and after the implementation of Lean management? How would you rate this change on a scale of 1 to 10?	Reduced costs with a significant 10/10 profit increase
	How did the supplier portfolio evolve before and after the implementation of Lean management? How would you rate this change on a scale of 1 to 10?	The development of the supplier portfolio is considered beneficial with sometimes less structured relationships and variable delivery times. The supplier portfolio has been streamlined to include strategic partners offering high quality raw materials, aligned with the company's objectives. 7/10
	How did revenues change before and after the implementation of lean production management? How would you rate this change out of 10?	Significant increase in production and productivity 7/10
Stocks manager	How has the application of Lean production management principles helped to reduce inventory levels? How do you rate this discount out of 10	When the storage time was reduced, we save space for the goods. 8/10
	How did warehousing change before and after implementing Lean Production Management? Can you rate this change out of 10?	Reduced storage time, reduced number of merchandises movements, organize the storage place, do not damage the finished products. 7/10
	What KPIs are used to assess and monitor the effectiveness of your inventory management?	Accuracy of demand forecasts, Cost of stocks, Stock rotation.

technical director	Finally, how do you think the implementation of the Lean method can have an impact on the operational performance of your company?	As I worked already 5 years in the Domain of quality management so I have a global vision on this approach when talking for example about the quality standards hygiene FSSC22000 is well applied that has 70% to his own company but there are some obstacles: we can't set the standards 100% well because there are always external influences, always the problem of turn over, personnel is not qualified that's why there are some obstacles but we are always looking for new solutions to apply these standards 100% in the future
Financial and RH Director		Reducing labor costs has a positive impact
Production		
manager		We evaluate the efficiency of production processes by controlling productivity and waste rates, and we always strive to improve them.
Quality management manager		efficiency improvement

Source: elaborated by us

2.1.1. Analysis of results

We will integrate an analysis grid into our study to examine the qualitative data obtained from the interviews we conducted. This grid is a tool that provides pre-established criteria for analyzing and interpreting the qualitative data collected. Several indicators were developed to analyze the interviews, based on different sections:

- (+): Indicates a positive answer
- (-): Indicates a negative answer
- (0): Indicates a neutral answer
- (/): Indicates no answer

During the analysis, we will examine how these indicators interact with our main variables, namely the application of lean management principles and operational performance.

Qualitative Analysis Grid of section 01:

This Qualitative Analysis Grid: includes an analysis of the first section of our interview, which focuses on the company's presentation and particularity.

Table 7 Analytical representation of the first section, which focuses on the company's presentation and special features

Questions	**individuals**				
Could you provide us with information about your company, its main sectors of activity, and its main strengths?	technical director	Financial and HR Director	production manager	Quality management manager	Stocks manager
Indicators	(+)	(+)	(+)	(+)	(+)
Speaking of strengths, could you also share your perspective on the company's main weaknesses?	technical director	Financial and HR Director	production manager	Quality management manager	Stocks manager
Indicators	(-)	(0)	(-)	(-)	(-)
Can you give us an overview of your company's activities and present both the local and global market in which you operate?	technical director	Financial and HR Director	production manager	Quality management manager	Stocks manager
Indicators	(0)	(+)	(+)	(+)	(+)
How would you describe the environment in which your business operates? What are the main challenges you face?	technical director	Financial and HR Director	production manager	Quality management manager	Stocks manager
Indicators	(+)	(+)	(-)	(-)	(+)
What values do you consider most important for your company? How does your company communicate these values to its employees?	technical director	Financial and HR Director	production manager	Quality management manager	Stocks manager
Indicators	(+)	(+)	(+)	(+)	(+)
Could you briefly describe your organization's objectives? How do you assess the success of your organization in meeting these goals?	technical director	Financial and HR Director	production manager	Quality management manager	Stocks manager
Indicators	(+)	(+)	(+)	(+)	(+)

Source: elaborated by us

- **Question 1:** Based on the responses and analysis, it is noted that EURL DEGLA EXPO is a company specialized in the exploitation and export of dates, created in 2016. It stands out

for the quality of its products, its international certifications (FSSC22000, Kosher, Fisma, European Organic). Furthermore, the company's strengths include: The production of high-quality dates, Compliance with hygiene standards and international standards, A qualified team and impeccable packaging, Customer satisfaction and excellent value for money. These aspects demonstrate the effective application of lean management principles, aiming to maximize value for customers while minimizing waste.

- **Question 2:** It is evident that the main weaknesses identified are: Illegal competition, Unskilled labor and high turnover, Lack of modern equipment, often imported from abroad. These weaknesses indicate areas where the company could benefit from the implementation or improvement of lean management practices to strengthen its capabilities and competitiveness.
- **Question 3:** It is noted that the company is active only in the international dates market.
- **Question 4:** It is evident that the company's operational environment is described as favorable but competitive, with strong competition. The challenges include: Managing production and distribution, ensuring product quality, Adapting to a changing and competitive environment. The company appears to be well-positioned in the international market but must constantly adapt and improve its processes to maintain and strengthen its position.
- **Question 5:** It is noted that the company's core values include: Integrity, respect, and commitment to quality, Cleanliness, discipline, and customer satisfaction, A strong emphasis on continuous training and awareness of the staff.
- **Question 6:** It is evident that the company's goals are: Improve product quality, expand its presence in international markets, improve consumer satisfaction, encourage increased production while maintaining a high level of quality, Reduce customer complaints. These objectives align with lean principles, which aim to improve operations and maximize value for customers.

The analysis of the responses from the first section highlights the positioning of EURL DEGLA EXPO in the international market. However, challenges persist, notably illegal competition, unskilled labor, and a lack of modern equipment. By focusing on continuous improvement and optimizing its processes, the company can enhance its competitiveness and maintain its position

in the date market. The company's values and objectives are closely aligned with lean management principles, which bodes well for future development.

B. Section 02 Qualitative Analysis Grid:

This Qualitative Analysis Grid includes an analysis of the first section of our interview, which focuses on the evaluation of the application of lean management principles in the company

Table 8 Analysis representation of the first section that focuses on the evaluation of the application of lean management principles in the company

individuals	**Questions**	**Indicators**
technical director	Can you explain what Lean Management means to you?	(+)
	Have you implemented lean management initiatives in your organization? If so, could you share some examples and results?	(+)
	What criteria were used to select them?	(+)
	Why did you choose lean production management over another management method, and does your company use other management methods?	(+)
	Let's talk about lean management. How do you think applying lean management principles can help your business?	(+)
	What problems does your company seek to solve by implementing lean production management?	(+)
Financial and HR Director	Can you explain what Lean Management means to you?	(+)
	Let's talk about lean management. How do you think applying lean management principles can help your business?	(+)
	How does your organization integrate the principle of "creating value for the customer" into its activities?	(+)
	What budget approach do you use for continuous improvement within your organization?	(+)
	Can you provide information on the composition of the company's current workforce?	(+)
	What personnel development programs have been implemented to improve operational performance?	(+)
	What policies and practices are adopted for employee performance management?	(+)
	How are employees involved in the implementation of lean management methods and what training is provided in this regard?	(+)
	How do you encourage employees to take a continuous improvement approach?	(+)
	What methods are used to encourage employees to apply these continuous improvement approaches?	(+)
Production manager	Can you explain what Lean Management means to you?	(+)
	Let's talk about lean management. How do you think applying lean management principles can help your business?	(+)
	What techniques are used to minimize variations in the production chain?	(+)
	What is the current state of production in relation to the planned objectives?	(+)
	What are the main production challenges you face and what strategies are used to overcome them?	(+)
	What are the approved productivity improvement plans?	(+)
	Can you explain what Lean Management means to you?	(+)
	Let's talk about lean management. How do you think applying lean management principles can help your company?	(+)

Quality management manager	How do you integrate Lean principles into operations?	(+)
	Where is the self-control and control of operators in the production chain?	(+)
	How do you manage cycles of non-compliance and continuous improvement?	(+)
	What quality control processes are in place?	(+)
	How do you use feedback to improve product quality? What Lean practices are used in this process?	(+)
Stocks manager	Can you explain what Lean Management means to you?	(+)
	Let's talk about lean management. How do you think applying lean management principles can help your company?	(+)
	How can transport processes be improved to reduce unnecessary travel?	(+)
	What strategies do you follow to ensure stock availability by working with suppliers?	(+)
	What are the main inventory management challenges you face and what steps are you taking to overcome them?	(+)

Source: elaborated by us

Technical Director:

- **Question 1:** It is noted that Lean management is suitable for the factory, as it facilitates management with a single raw material and is essential for obtaining international quality certifications.
- **Question 2:** It is observed that Lean initiatives are being implemented by establishing hygiene and quality standards, which have yielded positive results in terms of customer satisfaction and tax profitability. Recruitment of workers and managers has also been carried out to support these initiatives.
- **Question 3**: It is noted that the chosen methods aim to strictly apply quality and hygiene standards, demonstrating a focus on operational excellence.
- **Question 4:** Lean management has been chosen for its effectiveness in organizing teams, the supply chain, and for accessing international markets. Inventory management is also utilized.
- **Question 5:** The application of Lean principles is perceived as crucial for certifying products according to international standards, which is necessary for accessing international markets.
- **Question 6:** The goal is to improve team organization, master quality standards, and comply with customer specifications to avoid order rejections.

Finance and HR Director:

- **Question 1:** It is noted that for the Finance and HR Director, Lean management means
- **Question 2:** The application of Lean principles, with a program approved by management, is perceived as beneficial for the company.
- **Question 3:** It is noted that the principle of "creating value for the customer" for the company is to provide high-quality products compared to the competition.
- **Question 4:** A flexible budget is used to allocate resources based on needs and priorities, thus promoting continuous improvement.
- **Question 5:** The workforce is diversified, with distribution according to necessary services and skills.
- **Question 6:** Various training programs and workshops are implemented to develop employees' skills.
- **Question 7:** An integrated performance management system, including goal setting, performance evaluation, and feedback, is used to improve performance.
- **Question 8:** Employees receive hands-on training on Lean methods and are rewarded for their contributions to process improvement.
- **Question 9:** Employees are encouraged to participate in continuous improvement processes through rewards and recognition for their innovative ideas.
- **Question 10:** Financial and non-financial incentives such as promotions, public recognition, and work-life balance are used to motivate employees.

Production Manager:

- **Question 1:** It is noted that Lean management is seen as a methodology to improve efficiency and enhance production feasibility.
- **Question 2:** The application of Lean principles speeds up the production chain through techniques such as root cause analysis and workplace organization.
- **Question 3:** It is noted that improving planning and organizing the supply chain is used to cope with demand variations.
- **Question 4:** Productivity improvement plans are in place to optimize production processes.

- **Question 5:** Fluctuations in global demand pose a challenge. Careful quality and cost management is necessary, involving close coordination with suppliers.
- **Question 6:** Modernization of technologies and equipment is being implemented to increase production efficiency.

Quality Management Manager:

- **Question 1:** It is noted that for quality management, Lean management is perceived as a method to improve product quality.
- **Question 2:** The application of Lean principles helps to reduce time, effort, and costs, while improving quality.
- **Question 3:** Integration of Lean principles includes workplace organization and cleanliness, as well as control of finished and semi-finished products.
- **Question 4:** Self-control is done in the middle of the production chain, while operator control is done at the end of the chain.
- **Question 5:** Non-conformity and continuous improvement cycles are managed by applying HACCP steps and the 5 M's.
- **Question 6:** Processes include monitoring of finished and semi-finished products, workplace cleanliness, and avoidance of allergens.
- **Question 7:** Feedback is used to train workers and assess their ability to monitor and correct errors.

Stocks Manager:

- **Question 1:** It is noted that for stock management within the company, Lean management is to produce at the lowest cost with the best quality.
- **Question 2:** The application of Lean principles is crucial for the company's success by reducing costs and storage time.
- **Question 3:** The application of Lean principles reduces unnecessary movements in storage areas.
- **Question 4:** Orders to suppliers are placed after the end of an export batch, ensuring efficient stock management.

- **Question 5:** Surplus goods can pose a problem, but rigorous management strategies are in place to overcome them.

The analysis of the interviews shows a predominantly positive adoption of lean management principles within the company, with a clear understanding of its benefits in terms of quality, cost reduction, and customer satisfaction. The mentioned challenges mainly concern managing demand fluctuations and continuously optimizing production processes. The application of Lean principles is perceived as essential for improving operational efficiency and competitiveness in international markets.

C. Section 03 Qualitative Analysis Grid:

This Qualitative Analysis Grid includes an analysis of the third section of our interview, which focuses on measuring the impact of the application of lean management principles on operational performance within the company.

Table 9 Analysis representation of the third section that focuses on measuring the impact of the application of lean management principles on operational performance in the company.

individuals	**Questions**	**Indicators**
Directeur Technique	How was progress assessed after the implementation of lean management and which performance indicators were used in this evaluation?	(+)
	Finally, how do you think the implementation of the Lean method can have an impact on the operational performance of your company?	(+)
Directeur Financier et RH	Can you give us an overview of your company's current financial situation? How do you assess it?	(+)
	What are the short- and long-term financial projections for the company? Can you provide an estimate of the percentage needed to achieve these projections?	(+)
	How does your organization use financial data to make strategic and operational decisions?	(+)
	How to assess the profitability of your company?	(+)
	What are the main financial indicators you use to assess your company's operational performance?	(+)
	What financial impacts do you expect from waste reduction in your organization?	(+)
	Can you describe your company's cost structure and its impact on profitability?	(+)
	What are the main operational costs your company faces and how do you see their evolution before and after the implementation of "lean management"? How do you rate this change	(+)

	How do you assess the effectiveness of your recruitment and retention processes, for example in percentage terms?	(+)
	Finally, how do you think the implementation of the Lean method can have an impact on the operational performance of your company?	(+)
Production manager	How did production schedules change before and after the adoption of lean management principles?	(+)
	How have working hours changed before and after the implementation of lean management principles?	(+)
	How did the amount of labor produce change before and after the implementation of lean management principles?	(+)
	What changes have occurred in production standards before and after the implementation of lean production management principles? Can you give an example?	(+)
	How has the amount of production waste and waste changed before and after the implementation of Lean principles? Can you provide a percentage estimate?	(+)
	Finally, how do you think the implementation of the Lean method can have an impact on the operational performance of your company?	(+)
Quality management manager	From your point of view, how has the use of Lean management methods contributed to reducing the number of final checks and quality non-conformities?	(+)
	What indicators are used to measure the quality of a company's products or services? Can you give a rating on a scale of 1 to 10?	(+)
	Have customer satisfaction surveys been conducted? How do you assess customer satisfaction before and after implementing Lean Management on a scale of 1 to 10?	(+)
	How did the customer portfolio evolve before and after the implementation of Lean management? How would you rate this change on a scale of 1 to 10?	(+)
	How did the supplier portfolio evolve before and after the implementation of Lean management? How would you rate this change on a scale of 1 to 10?	(+)
	How did revenues change before and after the implementation of lean production management? How would you rate this change out of 10?	(+)
	Finally, how do you think the implementation of the Lean method can have an impact on the operational performance of your company?	(+)
Stocks manager	How has the application of Lean production management principles helped to reduce inventory levels? How do you rate this discount out of 10	(+)
	How did warehousing change before and after implementing Lean Production Management? Can you rate this change out of 10?	(+)
	What KPIs are used to assess and monitor the effectiveness of your inventory management?	(+)
	Finally, how do you think the implementation of the Lean method can have an impact on the operational performance of your company?	(+)

Source: elaborated by us

Technical Director:

- **Question 1:** It is evident that progress has been evaluated using customer satisfaction and operating deadlines. The technical director emphasizes the importance of mastering variable and fixed costs in a competitive environment with over 15 factories. This indicates a structured and multidimensional approach to performance evaluation.
- **Question 2:** The technical director has a positive view of lean management, despite some obstacles such as turnover of unskilled personnel and external influences. He sees lean management as a method for better long-term application of quality standards.

Finance and HR Director:

- **Question 1:** It is evident that the financial situation is regularly evaluated through monthly and quarterly financial reports. This allows for operational continuity and quick identification of performance gaps.
- **Question 2:** Financial projections aim for increased revenue and cost optimization. This approach shows a positive and strategic anticipation of future performance.
- **Question 3:** Financial data is extensively used to guide strategic and operational decisions, demonstrating a robust integration of financial information in decision-making.
- **Question 4:** Profitability is assessed by monitoring revenues and expenses and calculating net profits. This shows rigorous use of financial indicators to measure financial performance.
- **Question 5:** Key indicators include total revenue, variable costs, net profit, and other financial ratios. This reflects a balanced and detailed approach to operational performance evaluation.
- **Question 6:** Waste reduction is expected to save money and remain competitive. This response shows a clear expectation of financial improvements through more efficient practices.
- **Question 7:** Cost structure includes elements such as raw materials and labor, and their management directly affects profitability. This demonstrates an understanding of the relationship between costs and profits.

- **Question 8:** Labor and raw material costs are the main challenges, but continuous improvement through the recruitment of qualified personnel shows positive evolution through lean management.
- **Question 9:** The efficiency of recruitment and retention processes is monitored through indicators such as employee retention and satisfaction. This shows a methodical approach to maintaining and improving workforce quality.
- **Question 10:** Labor cost reduction is seen as having a positive impact, indicating an optimistic perception of lean management on operational performance.

Production Manager:

- **Question 1:** It is evident that production schedules have been improved with reduced order execution times and optimized delivery times, indicating better time management.
- **Question 2:** Work has become more efficient with reduced overtime hours, reflecting more efficient use of human resources.
- **Question 3:** Labor productivity has increased by nearly 50%, showing a significant impact of lean management on workforce efficiency.
- **Question 4:** There has been a significant improvement in efficiency and a reduction in process variations, illustrating standardization and optimization of production standards.
- **Question 5:** A reduction of over 20% in production waste and waste has been observed, showing increased efficiency and decreased losses.
- **Question 6:** Lean management improves productivity and reduces waste rates, demonstrating its positive impact on operational performance.

Quality Management Manager:

- **Question 1:** Lean management has facilitated the reduction of final inspections and non-conformities, indicating an improvement in quality and process efficiency.
- **Question 2:** Quality is measured by various indicators and is rated 8/10, showing a positive evaluation of product quality.
- **Question 3:** Customer satisfaction is rated 9/10 after the implementation of lean management, indicating a notable improvement.

- **Question 4:** The client portfolio has increased with reduced costs and increased profits, rated 10/10, showing a very positive impact.
- **Question 5:** The supplier portfolio has been streamlined and aligned with company objectives, rated 7/10, indicating moderate but positive improvement.
- **Question 6:** Revenues have increased significantly, rated 7/10, reflecting a notable improvement in financial performance.
- **Question 7:** Lean management improves efficiency, indicating a positive impact on operational performance.

Stock Manager:

- **Question 1:** Reduction of stock levels has saved space, rated 8/10, showing significant improvement.
- **Question 2:** Warehousing has become more efficient with reduced storage time and goods movements, rated 7/10, indicating moderate optimization.
- **Question 3:** Performance indicators include forecast accuracy, stock cost, and stock turnover, rated 8/10, reflecting effective stock management.
- **Question 4:** The application of lean management has contributed to increased productivity and quality while reducing lead times, indicating a significant positive impact on operational performance.

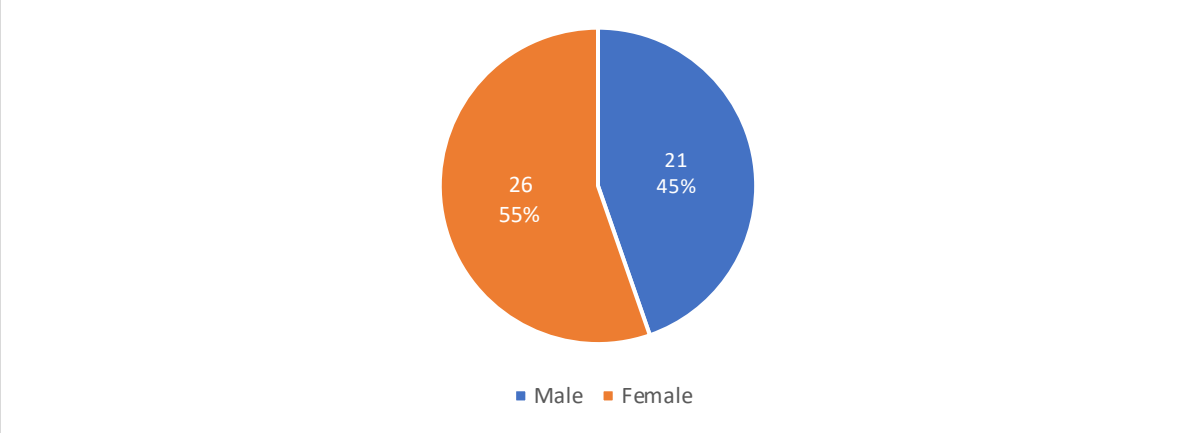
According to the analysis of the interviews, the responses from various managers generally demonstrate a positive perception of the impact of lean management on operational performance. The indicators used and the observed changes indicate improvements in efficiency, quality, customer satisfaction, and resource management. Positive indicators predominate, highlighting the benefits of lean management in various aspects of the company. Some obstacles are mentioned, particularly regarding the full application of quality standards, but overall, the effects of lean management are considered beneficial for the company.

2.2. Results of the Quantitative Study

2.2.1 Profile of Respondents

In this section, we will describe the different profiles of the Degla Expo team members who participated in our study, providing information on their gender, age, education level, socio-professional category, and professional experience.

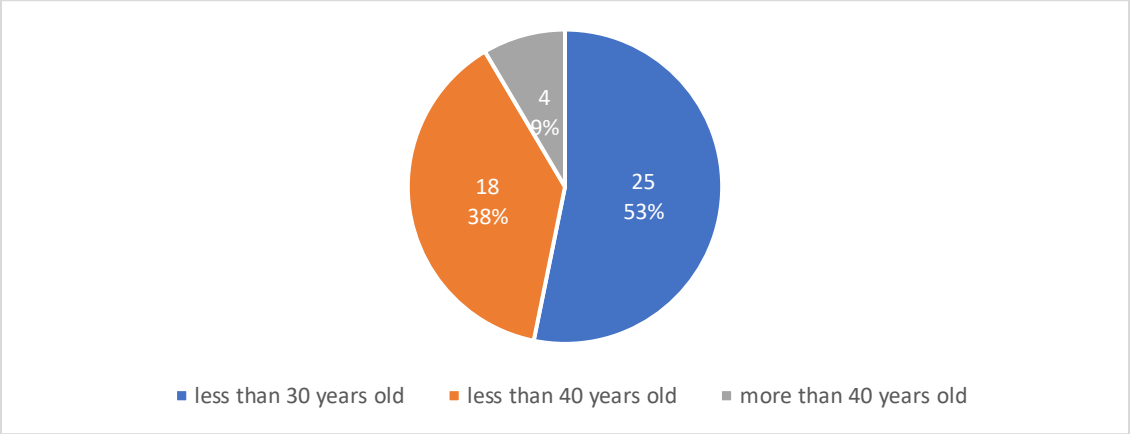
Figure 12 Gender representation of respondents



Source: elaborated by us from respondent's answers

According to the data presented in Figure 12, 45% of participants are males, or 21 people out of a total of 47 respondents. In contrast, 55% are females, representing 26 of the 47 respondents.

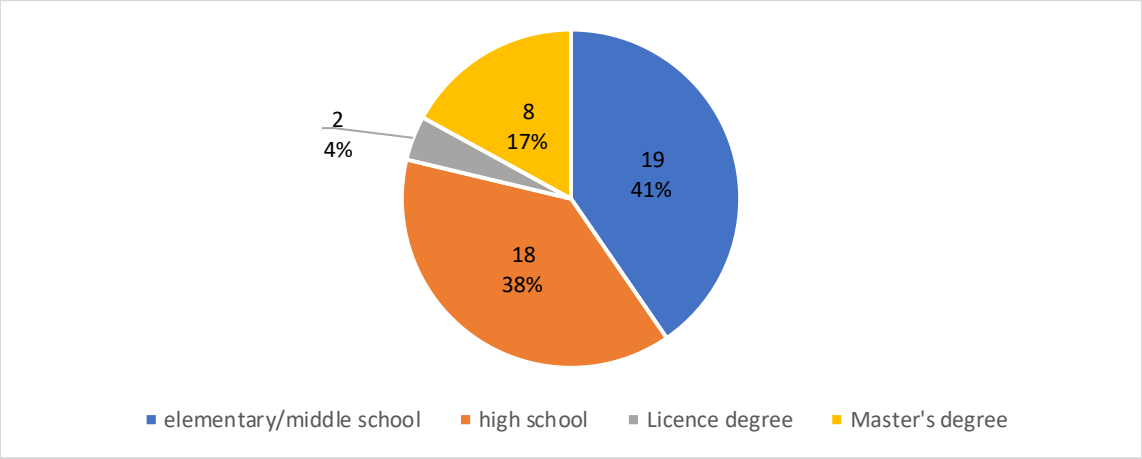
Figure 13 Age representation of respondents



Source: elaborated by us from respondent's answers

Based on the information's presented in Figure 13, our sample is divided into different age groups. It seems that 53% of the respondents, or 25 individuals, are under the age of 30. Subsequently, 38% of the respondents, or 18 people, are between the ages of 30 and 40. Finally, the remaining 9% represent 4 individuals over the age of 40.

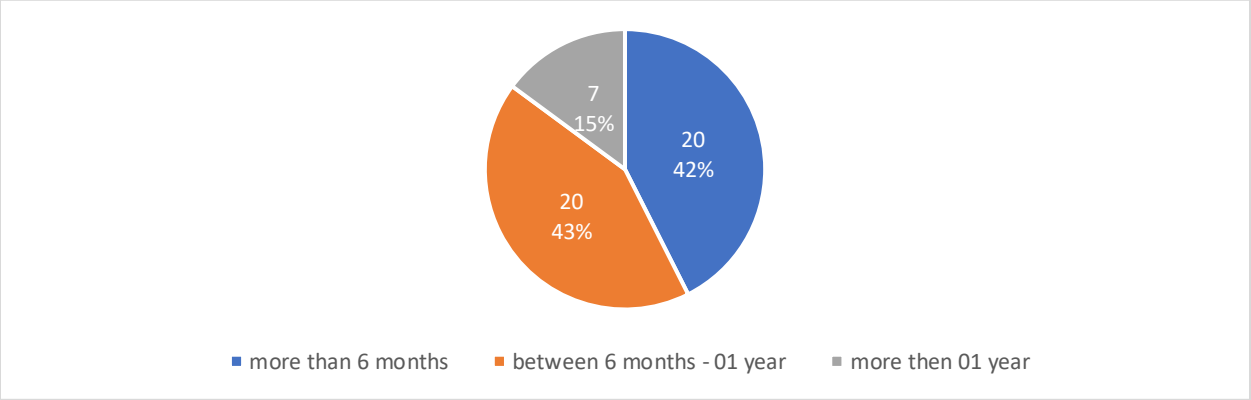
Figure 14 Representation of respondents' level of education



Source: elaborated by us from respondent's answers

The information in Figure 14 describes the level of education of our sample. It should be noted that 41% or 19 individuals reached the primary level. Then, 38% of the participants, totaling 18 individuals, have a secondary education. Finally, the others have achieved a university degree, divided as follows: 4% (2 people) have a bachelor's degree and 17% (8 people) have a master's degree.

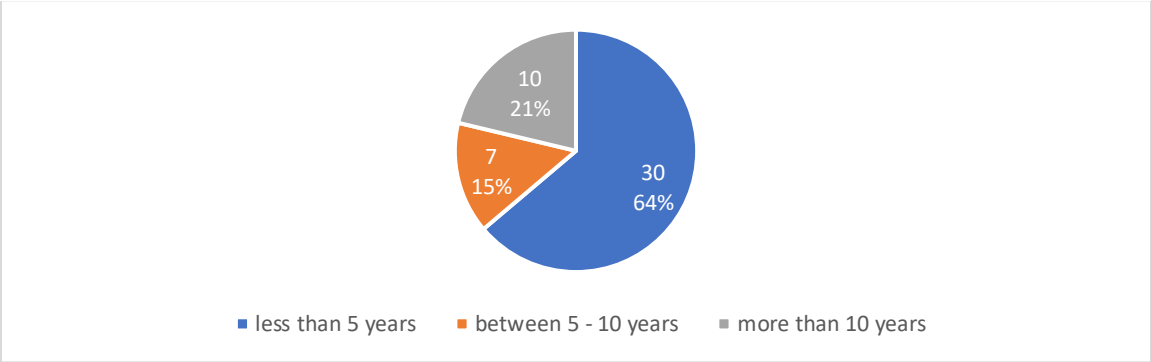
Figure 15 Representation of working time in the company for respondents



Source: elaborated by us from respondent's answers

The information provided in Figure 15 illustrates the working hours of the sample members within the enterprise. It is observed that 42% of them, or 20 people, have a professional experience of less than 6 months. Then, 43% of respondents, totaling 20 people, worked in the company for a period ranging from 6 months to a year. Finally, 15% of participants, representing 7 people, have a seniority greater than one year within the company.

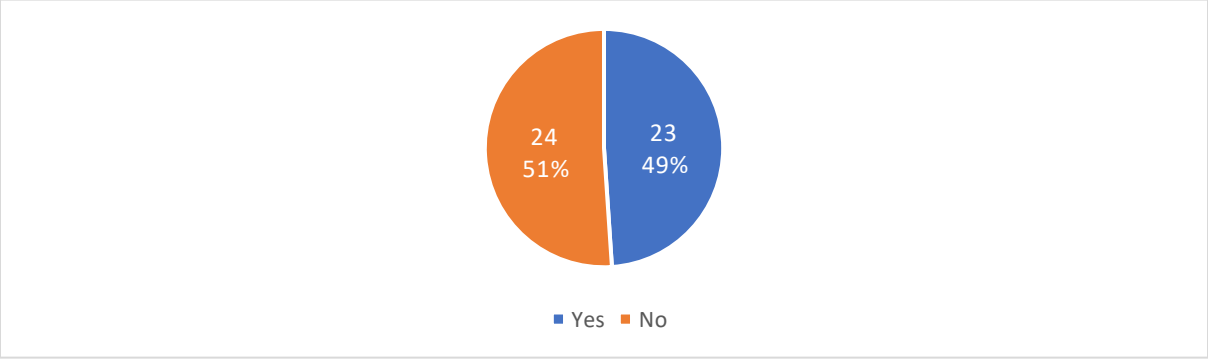
Figure 16 Representation of respondents' professional experience



Source: elaborated by us from respondent's answers

The data presented in Figure 16 describe the work experience of respondents. It is noted that 64% of them, or 30 people, have an experience of less than 5 years. In addition, 21% of participants, or 10 people, have experience between 5 and 10 years. Finally, 15% of individuals, or 7 people, have accumulated professional experience of more than 10 years.

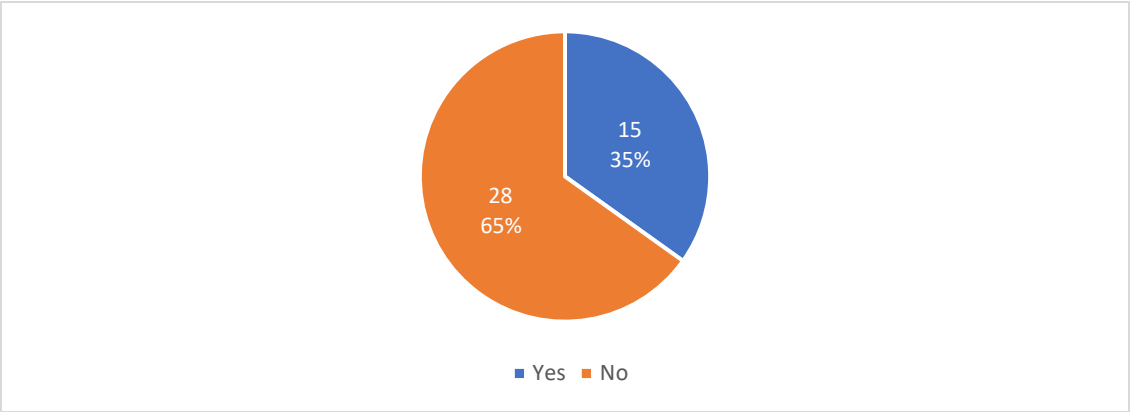
Figure 17 Representation of respondents with professional certificates or diplomas



Source: elaborated by us from respondent's answers

Figure 17 details the presence of professional certificates or diplomas among respondents. We find that 51% of participants, or 24 people, have this certificate or diploma. On the other hand, 49% of participants, or 23 individuals, have no professional certificate or diploma.

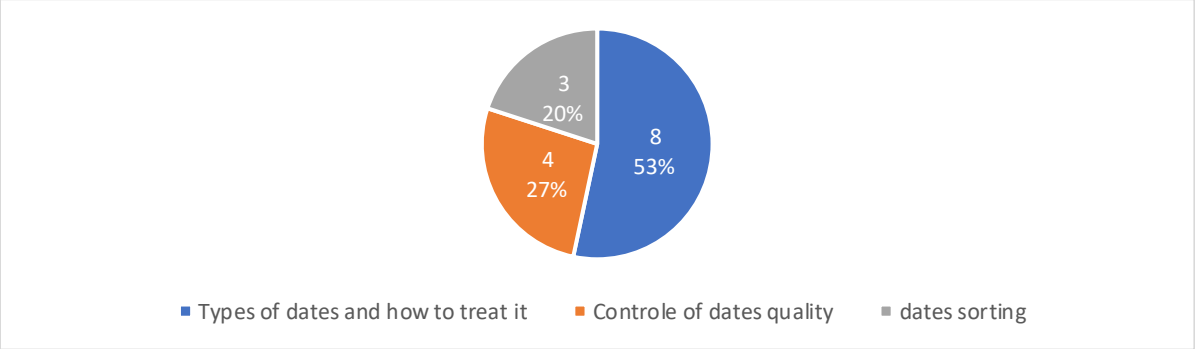
Figure 18 Representation of respondents who received training related to their current position



Source: elaborated by us from respondent's answers

The data provided in Figure 18 describe the participation of respondents in vocational training provided in the company. It was noted that 35% of the participants, or 15 people, received training. In return, 65% of respondents, or 28 people, did not receive training as part of their work within the company.

Figure 19 Representation of type of training received by respondents

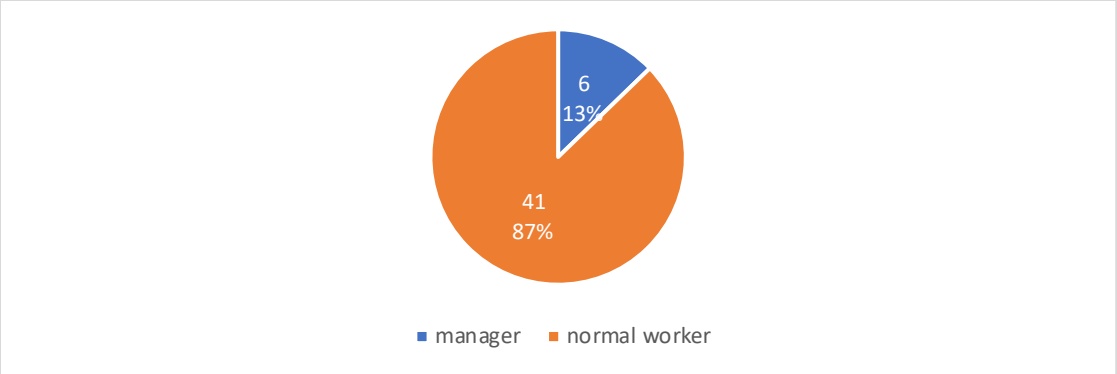


Source: elaborated by us from respondent's answers

Figure 19 shows in detail the different training courses taken by participants according to their functions within the company. It was found that 53% of the participants, or 8 individuals, received training on the various types of dates and how to treat them. In addition, 27% of participants, or 4

individuals, received training on date quality control at various stages of production. Finally, three people, or 20% of the remaining formations, focused on sorting dates.

Figure 20 Representation of socio-professional categories of respondents in the company



Source: elaborated by us from respondent's answers

The socio-professional categories of respondents within the company are represented in Figure 20. The master's degree category is therefore represented by 87% of respondents, or 41 individuals. On the other hand, 13% of the participants, or 6 people, occupy managerial positions within the company.

2.2.2. Stability of the Study Tool

To evaluate the reliability of the study tool, we relied on Cronbach's alpha coefficient, with the results presented in the following table:

Table 10 Representation of the reliability test of the study tool

reliability statistics	
Alpha Cronbach	number of questions
0.719637	37

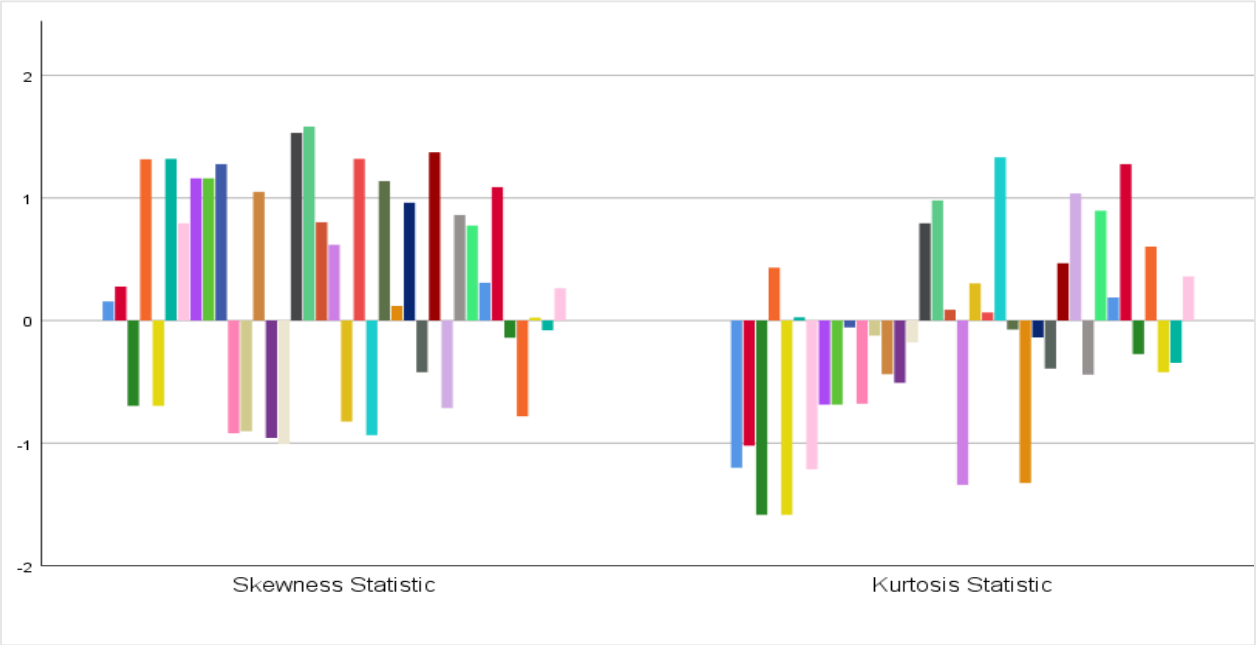
Source: elaborated by us using SPSS results

According to the table, the Cronbach alpha reliability coefficient exceeds 60% for the whole questionnaire, indicating the stability of the tool used in the study.

2.2.3. Normal distribution test of study variables

In analyzing the normal distribution, we refer to skewness and kurtosis coefficients, where a range limited to 2 and -2 indicates that the data distribution conforms to a normal distribution. Figure 21 presents the results of these tests:

Figure 21 Results of Normal Distribution of Study Variables



Source: elaborated by us using SPSS results

Based on the results in Figure 21, the skewness and kurtosis values fall within the acceptable range of -2 to 2, suggesting that the data distribution is approximately normal. This normality of data distribution is essential for the validity of subsequent statistical analyses.

2.2.4. Variable's correlation test (Pearson)

When analyzing the correlation between variables, we used the Pearson correlation test, where a range limited to 1 and -1 indicates that there is a positive relationship between the two variables. Table 11 presents the results of this test:

Table 11 Representation of Pearson test results

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q 1	Pearson Correlation	1	.283	-.385**	.538**	-.385**	.470**	-.157	.214	.274	.332*
	Sig. (2-tailed)		.054	.007	.000	.007	.001	.291	.148	.063	.022
	N	47	47	47	47	47	47	47	47	47	47
Q 2	Pearson Correlation	.283	1	-.529**	.415**	-.529**	.424**	-.194	.150	.284	.316*
	Sig. (2-tailed)	.054		.000	.004	.000	.003	.190	.313	.053	.030
	N	47	47	47	47	47	47	47	47	47	47
Q 3	Pearson Correlation	-.385**	-.529**	1	-.897**	1.000**	-.821**	.471**	-.529**	-.510**	-.815**
	Sig. (2-tailed)	.007	.000		.000	.000	.000	.001	.000	.000	.000
	N	47	47	47	47	47	47	47	47	47	47
Q 4	Pearson Correlation	.538**	.415**	-.897**	1	-.897**	.842**	-.488**	.503**	.608**	.805**
	Sig. (2-tailed)	.000	.004	.000		.000	.000	.001	.000	.000	.000
	N	47	47	47	47	47	47	47	47	47	47
Q 5	Pearson Correlation	-.385**	-.529**	1.000**	-.897**	1	-.821**	.471**	-.529**	-.510**	-.815**
	Sig. (2-tailed)	.007	.000	.000	.000		.000	.001	.000	.000	.000
	N	47	47	47	47	47	47	47	47	47	47
Q 6	Pearson Correlation	.470**	.424**	-.821**	.842**	-.821**	1	-.277	.197	.320*	.545**
	Sig. (2-tailed)	.001	.003	.000	.000	.000		.059	.184	.028	.000
	N	47	47	47	47	47	47	47	47	47	47
Q 7	Pearson Correlation	-.157	-.194	.471**	-.488**	.471**	-.277	1	-.711**	-.861**	-.680**
	Sig. (2-tailed)	.291	.190	.001	.001	.001	.059		.000	.000	.000
	N	47	47	47	47	47	47	47	47	47	47
Q 8	Pearson Correlation	.214	.150	-.529**	.503**	-.529**	.197	-.711**	1	.745**	.694**
	Sig. (2-tailed)	.148	.313	.000	.000	.000	.184	.000		.000	.000
	N	47	47	47	47	47	47	47	47	47	47
Q 9	Pearson Correlation	.274	.284	-.510**	.608**	-.510**	.320*	-.861**	.745**	1	.699**
	Sig. (2-tailed)	.063	.053	.000	.000	.000	.028	.000	.000		.000
	N	47	47	47	47	47	47	47	47	47	47
Q 10	Pearson Correlation	.332*	.316*	-.815**	.805**	-.815**	.545**	-.680**	.694**	.699**	1
	Sig. (2-tailed)	.022	.030	.000	.000	.000	.000	.000	.000	.000	

	N	47	47	47	47	47	47	47	47	47	47

		Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23
Q 11	Pearson Correlation	1	.826**	.348*	.245	.183	-.105	.128	.247	-.197	-.199	.058	.077	.031
	Sig. (2-tailed)		.000	.017	.097	.219	.484	.392	.094	.185	.180	.697	.605	.834
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 12	Pearson Correlation	.826**	1	.521**	.406**	.312*	-.223	.341*	.253	-.202	-.354*	-.134	.260	.237
	Sig. (2-tailed)	.000		.000	.005	.033	.131	.019	.086	.174	.015	.368	.078	.109
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 13	Pearson Correlation	.348*	.521**	1	-.186	.229	-.293*	.226	.299*	-.238	-.598**	.005	-.016	.051
	Sig. (2-tailed)	.017	.000		.211	.121	.046	.126	.041	.107	.000	.975	.914	.734
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 14	Pearson Correlation	.245	.406**	-.186	1	.096	-.200	.479**	-.132	.323*	-.069	-.357*	.766**	.616**
	Sig. (2-tailed)	.097	.005	.211		.523	.177	.001	.376	.027	.646	.014	.000	.000
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 15	Pearson Correlation	.183	.312*	.229	.096	1	-.148	-.066	.271	-.289*	-.111	-.319*	.081	.252
	Sig. (2-tailed)	.219	.033	.121	.523		.321	.661	.065	.049	.459	.029	.588	.088
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 16	Pearson Correlation	-.105	-.223	-.293*	-.200	-.148	1	-.664**	-.153	.218	.419**	.286	-.381**	-.314*
	Sig. (2-tailed)	.484	.131	.046	.177	.321		.000	.306	.140	.003	.051	.008	.032

	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 17	Pearson Correlation	.128	.341*	.226	.479**	-.066	-.664**	1	-.126	-.007	-.584**	-.498**	.671**	.435**
	Sig. (2-tailed)	.392	.019	.126	.001	.661	.000		.401	.964	.000	.000	.000	.002
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 18	Pearson Correlation	.247	.253	.299*	-.132	.271	-.153	-.126	1	-.520**	.119	.500**	-.018	.136
	Sig. (2-tailed)	.094	.086	.041	.376	.065	.306	.401		.000	.425	.000	.906	.362
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 19	Pearson Correlation	-.197	-.202	-.238	.323*	-.289*	.218	-.007	-.520**	1	-.095	.012	.125	.051
	Sig. (2-tailed)	.185	.174	.107	.027	.049	.140	.964	.000		.526	.935	.402	.734
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 20	Pearson Correlation	-.199	-.354*	-.598**	-.069	-.111	.419**	-.584**	.119	-.095	1	.370*	-.161	-.084
	Sig. (2-tailed)	.180	.015	.000	.646	.459	.003	.000	.425	.526		.011	.280	.575
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 21	Pearson Correlation	.058	-.134	.005	-.357*	-.319*	.286	-.498**	.500**	.012	.370*	1	-.395**	-.393**
	Sig. (2-tailed)	.697	.368	.975	.014	.029	.051	.000	.000	.935	.011		.006	.006
	N	47	47	47	47	47	47	47	47	47	47	47	47	47
Q 22	Pearson Correlation	.077	.260	-.016	.766**	.081	-.381**	.671**	-.018	.125	-.161	-.395**	1	.845**
	Sig. (2-tailed)	.605	.078	.914	.000	.588	.008	.000	.906	.402	.280	.006		.000
	N	47	47	47	47	47	47	47	47	47	47	47	47	47

Q23	Pearson Correlation	.031	.237	.051	.616**	.252	-.314*	.435**	.136	.051	-.084	-.393**	.845**	1
	Sig. (2-tailed)	.834	.109	.734	.000	.088	.032	.002	.362	.734	.575	.006	.000	
	N	47	47	47	47	47	47	47	47	47	47	47	47	47

		Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37
Q24	Pearson Correlation	1	-.674**	.184	-.204	.357*	-.333*	.312*	-.247	.292*	-.351*	-.044	-.214	-.128	-.285
	Sig. (2-tailed)		.000	.215	.170	.014	.022	.033	.102	.047	.016	.769	.149	.393	.053
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q25	Pearson Correlation	-.674**	1	.006	.434**	-.068	.510**	.042	.292	.014	.344*	-.030	.101	.107	-.030
	Sig. (2-tailed)	.000		.970	.002	.649	.000	.779	.052	.928	.018	.839	.501	.474	.840
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q26	Pearson Correlation	.184	.006	1	-.214	.489**	-.095	.561**	.079	.546**	-.177	-.214	.303*	-.174	.183
	Sig. (2-tailed)	.215	.970		.149	.000	.524	.000	.605	.000	.235	.148	.039	.241	.217
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q27	Pearson Correlation	-.204	.434**	-.214	1	-.121	.546**	.030	.346*	.044	.178	-.099	-.057	.021	.036
	Sig. (2-tailed)	.170	.002	.149		.416	.000	.843	.020	.769	.231	.509	.702	.889	.812
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q28	Pearson Correlation	.357*	-.068	.489**	-.121	1	-.269	.605**	.095	.556**	-.043	-.105	.083	-.171	-.080
	Sig. (2-tailed)	.014	.649	.000	.416		.067	.000	.535	.000	.776	.481	.580	.251	.593
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47

Q29	Pearson Correlation	-.333*	.510**	-.095	.546**	-.269	1	.036	.493**	.173	-.084	.162	.076	.281	-.160
	Sig. (2-tailed)	.022	.000	.524	.000	.067		.810	.001	.244	.573	.277	.610	.056	.283
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q30	Pearson Correlation	.312*	.042	.561**	.030	.605**	.036	1	.132	.928**	.042	-.242	.031	-.216	-.033
	Sig. (2-tailed)	.033	.779	.000	.843	.000	.810		.386	.000	.780	.102	.836	.144	.824
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q31	Pearson Correlation	-.247	.292	.079	.346*	.095	.493**	.132	1	.262	.009	-.076	.177	.064	.201
	Sig. (2-tailed)	.102	.052	.605	.020	.535	.001	.386		.082	.956	.620	.244	.678	.185
	N	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Q32	Pearson Correlation	.292*	.014	.546**	.044	.556**	.173	.928**	.262	1	-.077	-.247	.305*	-.206	.061
	Sig. (2-tailed)	.047	.928	.000	.769	.000	.244	.000	.082		.606	.094	.037	.166	.682
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q33	Pearson Correlation	-.351*	.344*	-.177	.178	-.043	-.084	.042	.009	-.077	1	.246	-.073	.216	.017
	Sig. (2-tailed)	.016	.018	.235	.231	.776	.573	.780	.956	.606		.095	.626	.145	.910
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q34	Pearson Correlation	-.044	-.030	-.214	-.099	-.105	.162	-.242	-.076	-.247	.246	1	-.104	.867**	-.176
	Sig. (2-tailed)	.769	.839	.148	.509	.481	.277	.102	.620	.094	.095		.488	.000	.237
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q35	Pearson Correlation	-.214	.101	.303*	-.057	.083	.076	.031	.177	.305*	-.073	-.104	1	-.027	.353*

	Sig. (2-tailed)	.149	.501	.039	.702	.580	.610	.836	.244	.037	.626	.488		.856	.015
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q36	Pearson Correlation	-.128	.107	-.174	.021	-.171	.281	-.216	.064	-.206	.216	.867**	-.027	1	-.039
	Sig. (2-tailed)	.393	.474	.241	.889	.251	.056	.144	.678	.166	.145	.000	.856		.794
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47
Q37	Pearson Correlation	-.285	-.030	.183	.036	-.080	-.160	-.033	.201	.061	.017	-.176	.353*	-.039	1
	Sig. (2-tailed)	.053	.840	.217	.812	.593	.283	.824	.185	.682	.910	.237	.015	.794	
	N	47	47	47	47	47	47	47	45	47	47	47	47	47	47

Source: elaborated by us using SPSS results

Looking at the matrix, we can see correlation coefficients between different question responses:

- **Lean Management Familiarity/Training (Q3-Q9):** Being familiar with lean concepts (Q3-Q6) has strong positive correlations with reducing production costs (Q18: 0.435**), reducing production time (Q24: 0.476**), reducing production problems (Q26: 0.379**), improving product quality (Q28: 0.181), and customer satisfaction (Q30: 0.169).
- **Employee training on lean methods (Q7-Q9):** is positively correlated with productivity improvements (Q21: 0.405**) and reduced production time (Q24: 0.320*). This suggests that having a good understanding of lean principles and providing training is linked to better operational metrics like lower costs, faster production, fewer issues, higher quality, and more satisfied customers.
- **Lean Tool Implementation (Q10-Q13):** Applying specific lean tools (Q10-Q13) shows strong positive correlations with productivity improvement (Q21: 0.551**), reduced production time (Q24: 0.621**), reduced production problems (Q26: 0.379**), and improved product quality (Q28: 0.181). This indicates that actively using lean management tools and techniques contributes significantly to enhancing productivity, reducing lead times, minimizing production issues, and increasing quality levels.

- **Performance Indicators (Q16-Q17):** Interestingly, implementing lean performance indicators (Q16-Q17) has negative correlations with productivity (Q21: -0.381**) and reduced production time (Q24: -0.400**). This suggests that while lean practices are broadly beneficial, care must be taken in how performance measurement systems are designed and implemented, as they can potentially hamper productivity and efficiency gains if not properly aligned.
- **Obstacles (Q20):** Encountering major obstacles during lean implementation (Q20) is negatively correlated with productivity improvement (Q21: -0.467**) and reduced production time (Q24: -0.584**). This highlights the importance of effective change management and addressing challenges proactively when adopting lean practices to ensure successful outcomes.
- **Perceived Effectiveness (Q35):** The perceived effectiveness of lean implementation (Q35) has very strong positive correlations with improved product quality (Q28: 0.928**), customer satisfaction (Q30: 0.305*), and worker motivation (Q32: 0.867**). This suggests that when lean management principles are implemented effectively, companies tend to experience substantial improvements in critical performance areas like quality, customer experience, and employee engagement.

Overall, the correlation data provides compelling evidence that there is a positive link between lean management principles and practices, and enhanced operational performance metrics across multiple dimensions: Familiarity with lean concepts and providing training is associated with lower costs, faster production, fewer issues, better quality, and higher customer satisfaction. Actively applying specific lean tools and techniques drives productivity increases, lead time reductions, minimization of production problems, and quality improvements. While lean practices are broadly beneficial, potential pitfalls like poorly designed performance measurement systems or major implementation obstacles can hinder productivity and efficiency gains if not addressed properly. When lean management is implemented effectively, companies report considerable improvements in key areas like product quality, customer satisfaction levels, and employee motivation/engagement.

In summary, we can say that lean management principles, when embraced comprehensively through training, tool application, change management, and effective implementation, can have a

significantly positive impact on multiple aspects of operational performance, including productivity, cost control, quality, customer experience, and employee motivation. However, potential challenges must be mitigated through careful planning and execution to fully realize lean's transformative potential.

2.2.5. Presentation and interpretation of results

The questionnaire used in the study shows the tendency of the sample members in the study through frequencies and percentages for each paragraph of the questionnaire and the degree of agreement with it.

A. Section 01: evaluation of respondents in terms of training and knowledge in lean management, as illustrated in the table below:

Table 12 Representation of the results of the Evaluation in terms of workers' training and knowledge of lean management.

Evaluation in terms of training and knowledge of lean management										
Q 1	Answers	No Answer	Staff Respect, Discipline, Responsibility, Respect of deadlines	Responsibility, customer satisfaction, Product Quality	Customer Satisfaction, Quality of product	Staff respect, discipline, responsibility	Discipline, respect of deadlines	Product quality	Satisfaction client	Respect of deadlines
	Frequency	8	2	6	9	4	4	2	6	6
	Percent	17	4	12	19	8	8	4	12	12
Q 2	Answers	No Answer	make a profit, guarantee product quality, achieve customer satisfaction	international expansion, guarantee product quality, achieve customer satisfaction	guarantee product quality, overcome market competition	make a profit, guarantee product quality	make a profit, guarantee product quality, achieve customer satisfaction		make a profit, achieve customer satisfaction	
	Frequency	10	8	5	10	6	4		4	
	Percent	21	17	10	21	12	8		8	
	Answers	Yes				No				

Q 3	Frequency	16			31	
	Percent	34			66	
Q 4	Answers	No Answer	Method to increase productivity	Quality improvement method	Production control method	Method for reducing costs
	Frequency	31	2	8	2	4
	Percent	66	4.3	17	4.3	8.5
Q 5	Answers	Yes		No		
	Frequency	16		31		
	Percent	34		66		
Q 6	Answers	No Answer	1	5	7	8
	Frequency	33	2	6	4	2
	Percent	70.2	4.3	12.8	8.5	4.3
Q 7	Answers	Yes		No		
	Frequency	20		27		
	Percent	42.6		57.4		
Q 8	Answers	No Answer		01 Week	01 month then 01 time per week	
	Frequency	27		16	4	
	Percent	57.4		34.0	8.5	
Q 9	Answers	No Answer		Organizing the workplace	Focus on quality	
	Frequency	29		6	12	
	Percent	61.7		12.8	25.5	

Q 10	Answers	No Answer	2023
	Frequency	35	12
	Percent	74.5	25.5

Source: elaborated by us using SPSS results

Results interpretation:

Table 12 presents an assessment of the respondents in terms of lean management training and knowledge. Based on the answers given to the first question, it appears that the most important values to which the company adheres are respect for employees, discipline, responsibility and respect of deadlines, while customer satisfaction is mentioned by 9 respondents and product quality by 19%, making it the most important of these values. Based on the answers given to the second question, we find that guaranteeing product quality and overcoming market competition are the company's main objectives, with 10 people agreeing with 21% of the answers given. According to the answers to the third question, a significant percentage of workers are familiar with lean management - 16 people (34%) - while the remaining 31 (66%) are not. According to the answers to the fourth question, workers think lean management is a method of improving and increasing quality, with 8 people agreeing with this statement (17%), while 4 people think it is a method of reducing costs (8.5%). According to the answers to the fifth question, the majority of respondents are not familiar with the principles of lean management, 31 people (66%), while a significant percentage of workers are familiar with the principles of lean management, 16 people (34%). According to the answers to question 6, the majority of people who know the principles of lean management rate their knowledge of these principles at 5/10 (6 people, 12.8%), while some people rate their knowledge of these principles at 7/10 (4 people, 8.5%). According to the answers to question 7, the majority of respondents (27, 57.4%) have not received any training in lean management, while 20 (57.4%) have. According to the answers to question 8, 16 people received training on the application of lean management principles for one week (34%), while 4 people received training for one month and continued it every week (8.5%). According to the answers to question 9 concerning the lean management tools learned during training, 12 people (25.5%)

replied that they had learned to focus on quality, while 6 people (12.8%) had learned to organize the workplace. Based on the answers provided to question 10, 12 respondents (25.5%) replied that the company began implementing lean principles in 2023.

The initial hypothesis is rendered invalid by the findings, which highlight a discernible disparity in workers' familiarity and training concerning lean management and its associated principles. While underscored values such as respect for employees, discipline, responsibility, and adherence to deadlines hold significance, they do not inherently encapsulate lean management tenets. Notably, the study reveals a corporate focus on ensuring product quality and attaining market dominance, suggesting a potential nexus between lean management and these objectives. However, the substantial proportion of workers lacking awareness of lean management principles (66%) underscores the imperative for enhanced training initiatives and heightened consciousness regarding these methodologies. Moreover, the findings elucidate that the employees more frequently perceive lean management as a vehicle for enhancing quality rather than solely as a cost-reduction mechanism, indicative of a nuanced yet incomplete grasp of the lean management paradigm. Furthermore, a notable proportion of the workforce has not undergone training in lean management application, underscoring the exigency for comprehensive training endeavors to augment awareness and proficiency. Additionally, the study elucidates that a majority of employees cognizant of lean management principles rate their understanding thereof as moderate (5/10), signifying ample scope for refinement in comprehension and application. The company's initiation of lean management principles in 2023 signals a proactive stance towards process enhancement and quality amelioration. In essence, effectuating lean production necessitates concerted efforts to mentor and educate personnel, instill awareness of lean production principles, and subsequently imbue them with motivation to integrate these principles into their daily operational framework.

B. Section 02: evaluation in terms of the application of lean management principles in the company, and the trends of the sample members are clear in the following table:

Table 13 Representation of the results of the Evaluation of the application of lean management principles in the company

Evaluation of the application of lean management principles in the company					
Q 1	Answers	No answer	5s	Ishikawa diagram	
	Frequency	37	6	4	
	Percent	78.7	12.8	8.5	
Q 2	Answers	No answer	5s		
	Frequency	35	12		
	Percent	74.5	25.5		
Q 3	Answers	On-site execution	Performance tracking		
	Frequency	43	4		
	Percent	91.5	8.5		
Q 4	Answers	No answer	We clean up the workplace	We organize the workplace	
	Frequency	33	6	8	
	Percent	70.2	12.8	17	
Q 5	Answers	No answer	Yes	No	
	Frequency	8	11	28	
	Percent	17	23.4	59.6	
Q 6	Answers	No answer	Yes	No	
	Frequency	2	17	28	
	Percent	4.3	36.2	59.6	
Q 7	Answers	No answer	Number of operations per day	The number of product units produced in a single order	Number of charge/discharge operations per day
	Frequency	30	4	9	4
	Percent	63.8	8.5	19.1	8.5
Q 8	Answers	No answer	Yes	No	
	Frequency	3	22	22	
	Percent	6.4	46.8	46.8	
	Answers	No answer	Number of workers is reduced	Number of transport buses is reduced	Number of overtime hours is reduced
	Frequency	25	18	2	2

Q 9	Percent	53.2	38.3	4.3	4.3
Q 10	Answers	No answer	Organization of the workplace	Attention to tools and personal hygiene has increased	
	Frequency	7	12	28	
	Percent	14.9	25.5	59.6	
Q 11	Answers	No answer	Yes	No	
	Frequency	5	14	28	
	Percent	10.6	29.8	59.6	
Q 12	Answers	No answer	Difficulty in adapting to changes in work methods	Sometimes the necessary equipment is not available	Difficulty adapting to changes in work methods, Sometimes the necessary equipment is not available
	Frequency	35	2	6	4
	Percent	74.5	4.3	12.8	8.5
Q 13	Answers	No answer	Communicate with colleagues to facilitate the work process	Creating temporary solutions	
	Frequency	35	6	6	
	Percent	74.5	12.8	12.8	

Source: elaborated by us using SPSS results

Results interpretation:

Table 13 shows the results of the evaluation of the application of Lean management methods in the field. According to the data collected, the tools most frequently used by respondents in the company are the 5s, with 6 people (12.8%), and the Ishikawa diagram, with 4 people (8.5%). As for the most commonly used tool, 12 people (25.5% of the sample) mentioned the 5s. As for the third question, 43 people (91.5%) answered positively. Five sample members actively apply lean management methods in the field, while 4 people (8.5%) are involved in performance monitoring. With regard to the fourth question, 6 people (12.8%) cited workplace cleaning as an example of application, and 8 people (17%) mentioned workplace organization. The majority of respondents (59.6%) have not adapted these methods to their work, while 11 people (23.4%) have made modifications. As far as performance indicators are concerned, 28 people (59.6%) have not implemented any measures, while 17 people (36.2%) have. As for the types of indicators used,

these vary from respondent to respondent. With regard to cost savings, responses were mixed, with 22 respondents (46.8%) reporting no reduction in costs, while 18 (38.3%) noted a decrease. A few people attributed these savings to factors such as reduced headcount or overtime. As far as organizational changes are concerned, a majority felt that they manifested themselves in better personal hygiene and cleaner tools. As for obstacles, 28 people (59.6%) encountered none, while 14 people (29.8%) mentioned difficulties, mainly linked to the unavailability of equipment or adaptation to new work processes. Finally, to overcome these obstacles, temporary solutions and communication with colleagues were mentioned.

The second hypothesis is substantiated by the data, as evidenced by the utilization of various Lean tools such as the 5S method and the Ishikawa diagram. This attests to the integration of foundational Lean concepts within the company's operational framework. The findings further reveal a substantial proportion of respondents actively engaged in implementing Lean methodologies in their respective domains, indicative of the organization's steadfast commitment to their application in daily operations. Illustrative instances of tool application, notably workplace organization and cleanliness initiatives, underscore ongoing endeavors to streamline processes and enhance operational efficiency. Moreover, a significant segment of employees has instituted performance metrics to gauge their adherence to Lean methodologies, underscoring a trajectory towards continual improvement and the attainment of predefined objectives. However, the findings also shed light on challenges inherent in Lean implementation, such as equipment shortages and resistance to workflow changes. These obstacles necessitate concerted efforts to surmount and ensure the effective deployment of Lean methodologies. Some participants have navigated these challenges through interim solutions and enhanced communication channels with peers, indicative of adaptability and a proactive approach to perpetually refine the work environment. In summation, the findings reflect commendable strides in Lean method application, albeit punctuated by challenges warranting concerted attention and mitigation efforts. Addressing these challenges is imperative to fully harness the potential of Lean methodologies in enhancing processes and realizing organizational objectives.

C. Section 03: assessment in terms of the impact of lean management principles on the operational performance of the company, and the trends of the sample members are clear in the following table:

Table 14 Representation of the results of Measuring the impact of lean management principles on the company's operational performance

Measuring the impact of Lean management principles on the company's operational performance							
Q 1	Answers	No answer	Totally agree	Agree	Neutral	Disagree	Totally disagree
	Frequency	0	2	24	12	7	2
	Percent	0	4.3	51.1	25.5	14.9	4.3
Q 2	Answers	No answer	50%	60%	70%		
	Frequency	27	6	8	6		
	Percent	57.4	12.8	17.0	12.8		
Q 3	Answers	No answer	Totally agree	Agree	Neutral	Disagree	Totally disagree
	Frequency	6	0	16	18	7	0
	Percent	12.8	0	34.0	38.3	14.9	0
Q 4	Answers	No answer	Distributing time to complete orders efficiently	Reduce production interruptions due to outages, allocate time to complete orders properly			
	Frequency	35	10	2			
	Percent	74.5	21.3	4.3			
Q 5	Answers	No answer	Totally agree	Agree	Neutral	Disagree	Totally disagree
	Frequency	3	2	20	20	2	0
	Percent	6.4	4.3	42.6	42.6	4.3	0
Q 6	Answers	No answer	Improving product quality	Organization of the workplace	Communication between workers has improved	Reduce the number of workers, increase discipline and quality control	Better distribution of tasks
	Frequency	29	2	6	4	4	2
	Percent	61.7	4.3	12.8	8.5	8.5	4.3
Q 7	Answers	No answer	Totally agree	Agree	Neutral	Disagree	Totally disagree
	Frequency	5	0	36	4	2	0
	Percent	10.6	0	76.6	8.5	4.3	0

Q 8	Answers	No answer	Obtaining quality certificates			Increase in the number of orders		
	Frequency	17	18			12		
	Percent	36.2	38.3			25.5		
Q 9	Answers	No answer	Totally agree	Agree	Neutral	Disagree	Totally disagree	
	Frequency	5	0	30	10	2	0	
	Percent	10.6	0	63.8	21.3	4.3	0	
Q 10	Answers	No answer	No customer complaints		Increase in the number of orders		Customer contract renewal	
	Frequency	25	12		8		2	
	Percent	53.2	25.5		17.0		4.3	
Q 11	Answers	No answer	Totally agree	Agree	Neutral	Disagree	Totally disagree	
	Frequency	8	0	21	10	8	0	
	Percent	17.0	0	44.7	21.3	17.0	0	
Q 12	Answers	No answer	Gain experience in the field of quality		Offer financial bonuses when productivity increases		Providing certificates to honor workers	
	Frequency	33	4		8		2	
	Percent	70.2	8.5		17.0		4.3	
Q 13	Answers	No answer	Totally agree	Agree	Neutral	Disagree	Totally disagree	
	Frequency	6	0	29	10	2	0	
	Percent	12.8	0	61.7	21.3	4.3	0	
Q 14	Answers	No answer	Numerous quality certificates have been obtained	Customer satisfaction has been achieved		Facilitate and accelerate the way we work	Improved production quality and quantity	
	Frequency	22	8	9		4	4	
	Percent	46.8	17.0	19.1		8.5	8.5	

Source: elaborated by us using SPSS results

Results interpretation:

Table 14 presents the results of the evaluation of the impact of the application of lean management methods on the company's operational performance. Based on responses to the first question, the majority of respondents, 24 individuals (51.1%), agree that they have noticed an improvement in their productivity since adopting Lean principles, while the remainder are neutral, 12 individuals (25.5%), disagree, 7 individuals (14.9%) strongly agree, 2 individuals (4.3%) disagree that their productivity has improved. According to people's answers to the second question, 8 people feel that their productivity has increased by 60%, while another 6 people feel that it has increased by 70%, and the same number of people feel that it has increased by 50%, while the others prefer not to answer. According to the answers to the third question, the majority of the sample, 18 people (38.3%), were neutral as to the contribution of the application of lean management methods to the reduction of production time, while 16 people (34%) agreed that the application of these methods contributed to the reduction of production time, while 7 people disagreed and the remaining 6 preferred not to answer. According to the answers to the fourth question, 10 people (21.3%) thought that the time needed to complete orders had become shorter than before, while 2 people (4.3%) thought that in addition to the reduction in the time needed to complete orders, the number of breakdowns disrupting the production process had been reduced, while the remaining 35 people preferred not to answer. According to the answers to the fifth question, the majority of respondents were divided between those who agreed that the application of lean management methods had helped to reduce problems during the production process (20 people, or 42.6%) and those who were neutral (20 people), while 2 people disagreed, 2 people strongly agreed and the remainder preferred not to answer this question. According to the answers to the sixth question, 6 people (12.8% of the sample) think that the reduction in production problems is due to the organization of the workplace, 4 people (8.5% of the sample) think that it is due to the reduction in the number of workers, which improves discipline and facilitates quality control, 4 people think that communication between workers has improved, 2 others think that it is due to a good distribution of tasks, and the same number think that it is due to the improvement in product quality. According to the answers to the seventh question, 36 (76.6%) of the sample agree that the application of lean management techniques has had a positive impact on product quality, while 4 (8.5%) are neutral, 2 (4.5%) disagree and the remainder prefer not to answer. According to the answers to the eighth question, 18 (38.3%) of those questioned believe that this effect is represented by the company

obtaining numerous quality certificates in its field of activity, while 12 (25.5%) think that this effect is represented by an increase in the number of orders compared to the previous one, the remaining 17 respondents preferred not to answer. According to the answers to question 9, 30 respondents (63.8%) agreed that the application of lean management techniques had had a positive impact on customer satisfaction, while 10 respondents (21.3%) were neutral, 2 respondents disagreed and the remaining 5 respondents preferred not to answer. According to the answers to question 10, 12 respondents (25.5%) think that this positive impact is due to the absence of customer complaints, 8 respondents (17%) think it is due to the increase in the number of orders, 2 respondents think it is due to the renewal of customer contracts, and the others preferred not to answer. According to the answers to question 11, 21 people (44.7%) agreed that the application of lean management methods in the company had a positive impact on worker motivation, while 10 people (21.3%) were neutral, 8 people (17%) disagreed and the remaining 8 people preferred not to answer the question. According to the answers to question 12, 8 respondents (17%) think that financial incentives provided in the event of increased productivity constitute the positive effect of lean management methods on worker motivation, while 4 respondents (8.5%) think it's about obtaining expertise in the field of quality, 2 respondents (4.3%) think it's about awarding certificates and distinctions to workers, while the remaining respondents preferred not to answer the question. According to the answers to question 13, 29 (61.7%) of the respondents agreed that the application of lean management methods in the company is effective, 10 (21.3%) were neutral, 2 (4.3%) disagreed, and the remainder preferred not to answer. According to the answers to question 14, 9 respondents (19.1%) think that the effectiveness of the application of these methods is due to customer satisfaction, 8 respondents (17%) think that this effectiveness is due to the company obtaining numerous quality certificates, 4 respondents (8, 5%) think it's due to facilitating the way work is done, and 4 respondents (4%) think it's due to improving the quantity and quality of production, while the remaining 22 respondents preferred not to answer.

The third hypothesis finds validation in the study results, as the majority of respondents attest to an enhancement in operational efficiency subsequent to the incorporation of Lean principles. This consensus underscores a discernible amelioration in operational performance attributable to Lean methodologies. Furthermore, the variable consensus among participants regarding this efficiency augmentation lends credence to the notion that Lean principles wield a substantial impact in this regard. Moreover, nearly two-thirds of respondents report a decrease in production duration

consequent to the implementation of Lean methods, underscoring their efficacy in streamlining operations. Additionally, a notable proportion of participants observe an enhancement in product quality, indicative of progress in processes and procedures pertinent to quality assurance. Furthermore, a majority notes an uptick in customer satisfaction, emblematic of a heightened responsiveness to customer requisites. Notably, there is unanimity regarding the affirmative influence of Lean principles on employee motivation, emphasizing their capacity to bolster team morale and productivity. Collectively, these findings affirm that the adoption of Lean principles has engendered tangible improvements in operational performance by augmenting efficiency, curtailing production durations, enhancing product quality, elevating customer satisfaction levels, and fostering employee motivation. Such empirical evidence buttresses the efficacy of integrating Lean principles as a strategic management approach within the organizational framework.

2.3. Discussion of results

To address the question of the correlation between Lean principles and operational performance, and to assess the effect of applying these principles on operational performance, we examined the results obtained from interviews and questionnaires. Therefore, it is now possible to discuss these results by comparing the findings from our qualitative study with those from our quantitative study. The results from the interviews and questionnaires converge towards a unanimous conclusion: there is a significant link between Lean management and operational performance. Additionally, the impact of Lean Management principles on operational performance is positive.

First, in terms of efficiency and productivity, the participants report tangible improvements. The Technical Director observes an increase in productivity and a reduction in delivery times, while the Production Manager notes a significant improvement in production schedules and a remarkable increase in labor productivity.

Next, cost and waste reduction is highlighted, with notable testimonials from the Finance and HR Director on the reduction of operational costs and better profitability. Similarly, the Inventory Manager reports a significant decrease in inventory levels, allowing for space savings and improved storage efficiency. Regarding quality and customer satisfaction, the Quality Management Manager notes an improvement in product quality and increased customer satisfaction, with a reduction in non-conformities and final inspections. The questionnaires confirm these observations, highlighting a notable improvement in productivity, operational

efficiency, cost reduction, and more effective inventory management. Additionally, product quality and customer satisfaction are positively evaluated.

When evaluating the hypotheses, the data reveal strong support for the hypothesis that Lean Management principles have a positive impact on operational performance. No elements suggest any significant negative impact; on the contrary, Lean practices seem to mitigate operational challenges rather than exacerbate them.

In conclusion, the results confirm that the application of Lean Management principles is strongly correlated with a significant improvement in operational performance, resulting in increased efficiency, improved productivity, better product quality, and more efficient cost management.

Conclusion

The study is contextualized by a significant change in the global economic landscape, prompting companies to adopt innovative management approaches to maintain their competitiveness. Lean, based on the Toyota Production System and developed by researchers at the Massachusetts Institute of Technology (MIT), emerges as an effective solution for improving companies' operational performance.

In this complex and highly competitive context of organizational management, we examined the role of lean management in relation to operational performance. The objective of our research was to understand: "Is there a link between the application of Lean management principles and the operational performance of the company? If there is a link between the two variables studied, what would be the nature of this link? And how does the application of Lean principles impact operational performance in organizations?"

We formulated two research hypotheses and adopted a methodology combining an exhaustive literature review with an empirical analysis based on data collected through interviews and a questionnaire distributed to company employees. This approach allowed us to validate our hypotheses. The initial objectives of this research were to determine the nature of the relationship between Lean principles and operational performance and to assess the effect of applying these principles. These objectives were fully achieved. The results of this study indicate that integrating Lean practices into operational processes can lead to substantial improvements in terms of:

- **Performance Improvement:** Applying Lean management principles has a significantly positive impact on companies' operational performance, notably in terms of quality, productivity, and customer satisfaction.
- **Process Optimization:** Lean methodology helps reduce waste, optimize production processes, and create a more efficient and motivating work environment for employees.
- **Continuous Innovation:** Lean management promotes a culture of continuous improvement and innovation, essential for meeting increasing market demands and anticipating future challenges.

These results confirm our hypothesis and show that there is a strong positive relationship between the two concepts, demonstrating the positive impact of Lean management principles on operational performance.

However, this study presents certain limitations:

- We were unable to obtain quantitative data from the company (number of workers, revenue, production standards, and costs) to quantitatively analyze the results of applying Lean principles on operational performance and compare them to the data collected in the questionnaire and interviews.
- The sample size, although sufficient for preliminary conclusions, could be increased to allow for broader generalization of the results.
- The study focuses on a single company, which may limit the diversity of operational contexts examined.
- Potential biases related to participants' responses and methodological constraints, such as dependence on self-assessments, must be considered.

These limitations open the way for future research. For future studies, it would be beneficial to expand the sample to several companies from different sectors to compare the effects of Lean practices in various contexts. Additionally, longitudinal studies could provide insights into the long-term impact of Lean management. A more in-depth investigation into specific interactions between different Lean principles and their impact on particular aspects of operational performance would also be valuable.

These results allow us to formulate the following recommendations:

For managers and companies:

- Adopt Lean principles: Integrate Lean practices to improve efficiency and quality.
- Train employees: Raise awareness and train staff at all levels on Lean practices.
- Create a culture of improvement: Foster an organizational culture that values innovation and continuous improvement.
- Conduct routine audits and upgrades to ensure the sustainability of Lean methods.

For researchers:

- Expand samples: Study multiple companies from different sectors to validate the results.
- Conduct longitudinal studies: Analyze the long-term effects of Lean practices.
- Explore interactions: Examine the specific impacts of different Lean principles.

- Diversify methods: Use case studies, quantitative analyses, and simulations for a comprehensive understanding.

In conclusion, this study confirms the relevance of Lean management as a lever for improving operational performance and highlights the importance of an integrated and continuous approach to maximize its benefits for organizations.

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A PPENDICES

APPENDICE A - INTERVIEW GUIDE

This interview is intended to be used as part of the practical placement for the final year project and is aimed at employees of the Degla Expo company. The interview aims to explore the nature of the relationship between lean management principles and operational performance. How does the application of lean management principles affect the operational performance of organizations?

Section 1: Company presentation and particularities:

Technical Director, Finance and HR Director, Production Manager, Quality Management Manager, Stock Manager:

- Can you tell us a little about your company, its main areas of activity and its strengths?
- Speaking of strengths, what do you see as the company's main weaknesses?
- Can you give an overview of your company's activities and present the local and global markets in which you operate?
- How would you describe the environment in which your organization operates? What are the main challenges it faces?
- What do you consider to be your organization's most important values? How does your organization communicate its values to its employees?
- Can you briefly describe your company's objectives? How does your company rate its success in achieving its objectives?

Section 02: evaluating the application of lean management principles within the company

Technical Director:

- Can you explain what lean management means to you?
- Have you implemented any lean management initiatives in your organization? If so, can you share some examples and the results obtained?
- What criteria were used to select them?
- Why were lean production management chosen over another management method, and does the company use other management methods?
- Let's talk about Lean. How do you think the application of Lean principles can help your organization?
- What problems is the company looking to solve by implementing lean production management?

Finance and HR Director:

- Can you tell us what Lean Management means to you?
- Let's talk about Lean Management. How do you think the application of Lean management principles can help your company?
- How does your organization integrate the principle of "customer value creation" into its activities?
- What budgeting approach do you use for continuous improvement within your organization?

- Can you provide information on the composition of the company's current workforce?
- What staff development programs have been implemented to improve operational performance?
- What policies and practices have been adopted to manage employee performance?
- How are employees involved in implementing lean management methods, and what training is provided in this respect?
- How do you encourage employees to adopt a continuous improvement approach?
- What methods are used to encourage employees to apply continuous improvement approaches?

Production manager:

- Are you familiar with the principles of Lean? Can you explain what it means to you?
- Let's talk about Lean. How do you think the application of Lean principles can help your company?
- What techniques are used to minimize variations in the production chain?
- What is the current state of production in relation to planned targets?
- What are the main production challenges you face, and what strategies are used to overcome them?
- What productivity improvement plans have been approved?

Quality management manager:

- Are you familiar with the principles of Lean Management? Can you tell us what Lean Management means to you?
- Let's talk about Lean Management. How do you think the application of Lean management principles can help your company?
- How do you integrate Lean principles into operations?
- Where do you place self-control and operator control?
- How do you manage non-conformance and continuous improvement cycles?
- What quality control processes are in place?
- How do you use feedback to improve product quality? What Lean practices are used in this approach?

Stock manager:

- Do you know the principles of lean management? Can you explain what Lean Management means to you?
- Let's talk about Lean Management. How do you think the application of Lean management principles can help your company?
- How can transport processes be improved to reduce unnecessary travel?
- What strategies do you follow to guarantee stock availability by working with suppliers?
- What are the main challenges you face in terms of inventory management, and what steps are you taking to overcome them?

Section 03: Measuring the impact of lean management on operational performance

Technical director:

- How was progress assessed after its implementation, and what performance indicators were used in this assessment?
- Finally, how do you think the implementation of Lean can impact a company's operational performance?

Finance and HR Director:

- Can you give us an overview of your company's current financial situation? How would you assess it?
- What are the company's short- and long-term financial projections? Can you provide an estimate of the percentage needed to achieve these projections?
- How does your organization use financial data to make strategic and operational decisions?
- How do you assess your company's profitability?
- What are the main financial indicators you use to assess your company's operational performance?
- What financial impact do you expect from waste reduction in your organization?
- Can you describe your company's cost structure and its impact on profitability?
- What are the main operational costs facing your company, and how do you see them evolving before and after the implementation of lean management? How do you assess this change?
- How would you rate the effectiveness of your recruitment and retention processes, for example in percentage terms?
- How do you think the application of lean management can affect the company's operational performance?

Production manager:

- How did production schedules evolve before and after the adoption of lean management principles?
- How did working hours evolve before and after the implementation of lean management principles?
- How did the quantity of labor produce change before and after the implementation of lean management principles?
- What changes occurred in production standards before and after the implementation of lean management principles? Can you give an example?
- What were the changes in the amount of production waste and wastage before and after the implementation of Lean principles? Can you provide a percentage estimate?
- How do you think the application of Lean can affect the company's operational performance?

Quality management manager:

- From your point of view, how has the use of Lean management methods helped to reduce the number of final inspections and quality non-conformities?
- What indicators are used to measure the quality of a company's products or services? Can you give a score on a scale of 1 to 10?
- Have customer satisfaction surveys been carried out? How would you rate customer satisfaction before and after the implementation of Lean management on a scale of 1 to 10?
- How did the customer portfolio evolve before and after the implementation of Lean management? How would you rate this change on a scale of 1 to 10?
- How did the supplier portfolio evolve before and after the implementation of Lean management? How would you rate this change on a scale of 1 to 10?
- How did revenues evolve before and after the implementation of Lean production management? How would you rate this change out of 10?
- How do you think the application of Lean management can affect the company's operational performance?

Stock manager:

- How has the application of Lean production management principles helped to reduce inventory levels? How would you rate this reduction out of ten?
- How did warehousing change before and after the implementation of Lean production management? Can you rate this change out of 10?
- What key performance indicators are used to evaluate and monitor the effectiveness of your inventory management?
- How do you think the application of Lean management can affect the company's operational performance?

APPENDICE B - QUESTIONNAIRE

This questionnaire is intended for use during the practical training phase of the final year project, and is aimed at employees of the Degla Expo company. The purpose of the questionnaire is to investigate the nature of the relationship between lean management principles and operational performance. How does the application of lean management principles affect the operational performance of organizations?

Section 1: Personal data

The purpose of this section is to identify certain personal and professional data with a view to analyzing the results at a later date. Please answer the questions by placing an "X" in the appropriate box.

1- Gender: Male ☐ Female ☐

2- Age: under 30 ☐ under 40 ☐ over 40 ☐

3- Level of education:

Primary/middle ☐ Secondary ☐ Liecence ☐ Master ☐ Doctorate ☐

4- Working period in the company:

Less than 06 months ☐ 06 months - 01 year ☐ more than 01 year ☐

5- Professional experience:

Less than 5 years ☐ between 5-10 years ☐ more than 10 years ☐

6- Diplomas and training:

Do you have any professional certificates or diplomas? If yes, please list them.

Yes ☐ No ☐

……

Have you taken any professional training courses relevant to your current position? If so, please list them.

Yes ☐ No ☐

……

7- Company activity:

Executive Manager ☐ Senior Manager ☐ Supervisor ☐ Normal worker ☐

Section 1: Training and knowledge of employees on Lean management

What do you think are the most important values your company stands for? (Name them)

……

Can you briefly describe your company's main objectives?

……

Are you familiar with the concept of Lean management?

Yes ☐ No ☐

If yes, can you explain what lean management means to you?

……

Are you familiar with the principles of lean management?

Yes ☐ No ☐

To what extent out of 10 are you familiar with the basic principles of Lean management?

……

Have you taken specific training on the implementation of Lean management methods and principles in your work?

Yes ☐ No ☐

If yes, please indicate the duration of the training you have attended.

……

During the training, what Lean management methods or tools did you learn?

……

When did your company start using Lean management?

……

Section 02: How this approach has been implemented in the field

Can you identify the main Lean management tools that have been implemented in your work?

……

Which Lean management tools and techniques have you used more than others? (Name them)

……

At what level were you involved in the implementation of Lean management methods?

Process design ☐

Implementation in the field ☐

Performance monitoring ☐

Other (please specify) ☐

……

Can you give a concrete example of the application of Lean management in a specific project or process (in brief)?

……

Have there been any specific modifications or adjustments to Lean management principles to better fit your work?

……

Have you implemented specific indicators to measure your performance in Lean management?

Yes ☐ No ☐

If yes, what are these indicators and how were they measured?

……

Have you noticed a reduction in production costs through Lean management?

Yes ☐ No ☐

If yes, can you give examples of where costs have been reduced?

……

Can you describe the changes noticed in the organizational culture since the introduction of lean management?

……

Have you encountered any obstacles when implementing lean management in your company?

Yes ☐ No ☐

If yes, what were the main challenges you faced?

……

How did you overcome these obstacles?

……

Section03: Measuring the impact of Lean management principles on the company's operational performance

Have you noticed an improvement in your productivity since adopting the Lean management principle?

Totally agree	Agree	Neutral	Disagree	Totally disagree

Give us an estimated percentage?

……

Has the application of Lean management methods helped reduce production time in your company?

Totally agree	Agree	Neutral	Disagree	Totally disagree

How did it help?

……

Has the application of Lean management methods helped to reduce problems during the production process in your company?

Totally agree	Agree	Neutral	Disagree	Totally disagree

How did it help?

……

Has the application of Lean management methods had a positive impact on the quality of your company's products?

Totally agree	Agree	Neutral	Disagree	Totally disagree

If you agree, how?

……

Has the application of Lean management methods had a positive impact on customer satisfaction?

Totally agree	Agree	Neutral	Disagree	Totally disagree

If you agree, how?

……

Has the application of Lean management methods had a positive impact on employee motivation?

Totally agree	Agree	Neutral	Disagree	Totally disagree

If you agree, how?

……

Has the application of Lean management in your company been effective?

Totally agree	Agree	Neutral	Disagree	Totally disagree

Why or why not?

……