Enhancing Lean Implementation in SMEs: Exploring Barriers and HRM Strategies

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Abstract

This study focuses on analyzing the barriers that Small and Medium-sized Enterprises (SMEs) face when implementing Lean tools and how these barriers are related to Human Resource Management (HRM) practices. Through a systematic literature review, 45 academic articles were examined, identifying 20 Lean barriers that hinder the successful adoption of these tools. Lack of understanding (15.56%), Lack of financial capacity (11.11%), and Resistance to change (11.11%) were the most common barriers. In addition to identifying barriers, this study highlights critical factors characterizing these limitations and establishes a correlation between these critical factors and the three dimensions of the AMO model (Ability, Motivation, and Opportunity) focused on Human Resource Management. This suggests that proper talent management and employee motivation are essential elements to overcome barriers in Lean implementation. By expanding the understanding of specific obstacles that SMEs face on their path to Lean implementation, this work provides valuable insights for organizations to design more effective strategies. The contribution of Human Resource Management in employee engagement and commitment is also highlighted as a key factor in achieving a successful and efficient Lean development process. With this study, it is hoped that SMEs can address the identified barriers and adopt Lean practices more effectively, enhancing their competitiveness and operational efficiency.

Keywords
Lean Manufacturing, SMEs, Barriers, HRM, and AMO model.

1. Introduction
The interest in Lean Manufacturing is experiencing steady growth in most large companies. However, in the majority of SMEs, this methodology remains unknown due to its perceived implementation difficulty. The Lean Manufacturing approach involves the participation of personnel at all levels, from executives to workers, to achieve success. Often, the main obstacles include resistance to change by employees, a lack of leadership, and the necessity for executives to understand and believe in the potential benefits (Sanz and Gisbert 2017). On the other hand, these barriers manifest themselves in both internal and external aspects, such as the financial and capital realm, the acquisition of knowledge and human resources, the understanding of management concepts and philosophies, and the accessibility to Lean tools and techniques, all of which constrain the development and implementation of the Lean methodology in SMEs (Zhou 2016). In relation to SMEs in the automotive sector of Malaysia that are undergoing a transitional process towards adopting Lean methodologies, the most prominent barriers are the lack of understanding of Lean tools, the absence of experienced administrators, and average administrative attitudes. Additionally, in the case of SMEs that are already in the implementation process, the lack of knowledge and understanding of Lean tools, as well as the attitude of the workers, are identified as the main barriers (Nordin et al. 2010).

On the other hand, in a study conducted among SMEs in the United Arab Emirates, a correlation has been established between the level of understanding of the lean methodology and the company's lifespan. It was observed that SMEs with less than one year of operation tend to erroneously associate the Lean concept with workforce reduction (Alefari et al. 2020). This situation highlights that SMEs with a shorter operational history lack fundamental knowledge about lean methodologies, and the prevailing concept in the survey is that of a toolkit for improving production. Furthermore, another study conducted on 31 SMEs in Sabah, Malaysia, revealed that approximately 74% of surveyed SMEs lack any type of knowledge or experience in lean methodologies, resulting in a significant lack of awareness about what Lean Manufacturing truly entails (Adzrie et al. 2021). The absence of commitment at different organizational levels of SMEs was also identified as an additional barrier. This hurdle was perceived by 150 SMEs in the United Arab Emirates, indicating that the lack of commitment both from top management and workers during the implementation process proves to be a predominant factor (Alefari et al. 2020). Similarly, in a sample of 33 SMEs in the Netherlands, it is highlighted that the necessary factors to overcome perceived barriers and achieve successful implementation include leadership, collaboration with suppliers, and a shared vision for enhancing the company (Knol et al. 2018).

Based on the responses from 45 surveys targeted at American SMEs, of which 11 are categorized as organizations in the process of lean approach implementation, it was revealed that the five most relevant obstacles for these companies are: cultural resistance to change, lack of time, tendency to revert to old practices, budget constraints, and absence of commitment from management. Three of these obstacles stem from a lack of initiative and commitment, particularly complex aspects to develop in the early stages for SMEs (Zhou 2016). Consequently, based on the gathered sources, multiple barriers and obstacles that complicate the lean implementation process in SMEs can be identified. The lack of knowledge about the lean methodology and the absence of commitment and initiative across different organizational levels emerge as the most prominent obstacles.

To achieve the desired outcomes, it is essential to identify the resistances and barriers that commonly affect SMEs (Small and Medium-sized Enterprises). In this context, Lean Production stands out as an effective tool for enhancing the performance of these companies. However, its implementation and benefits acquisition pose greater challenges for SMEs compared to large corporations (Belhadi et al. 2018). In the case of SMEs, the implementation of lean methodology can yield diverse results and proposals. This is because small businesses have a different approach to the implementation of lean tools (Valente et al. 2020).

The relevance of Human Resources (HR) in organizations during the implementation of lean tools is evident from the paragraphs above. Consequently, the AMO model focused on Human Resource Management (HRM) becomes significant. Through this model, companies can address issues related to HR practices and provide support to SMEs in managing their employees and increasing their level of engagement (Nor et al. 2021).

Considering the issues, the following research questions are posed: What obstacles or barriers are predominant in the implementation of lean tools in SMEs? What is the relationship between HR practices and the critical factors of lean practices? What is the relationship between HR practices that enhance employees' Abilities, Motivations, and Opportunities and the barriers in the implementation of the lean tool?

It is relevant to highlight that this research has identified a lack of information about the specific application of lean in SMEs, addressing barriers, issues, and tools during the implementation process. Much of the existing literature on lean in the context of SMEs is based on methods and tools designed for larger enterprises, underscoring the need for a precise selection of tools for proper and efficient implementation tailored to SMEs (Belhadi et al. 2018). The central focus of this work is oriented towards the development of the AMO model for HRM. The practice aimed at improving workers' skills is described through the three dimensions of the model: Ability, Motivation, and Opportunity. The AMO approach maintains that an employee with the capabilities, motivation, and opportunities to contribute their knowledge and skills will likely experience a high level of job satisfaction (Voos 2001).

The main objective of this study is to conduct a comprehensive analysis and identification of the critical factors underlying the most frequent barriers encountered by SMEs during the implementation of lean tools. This evaluation is carried out through a systematic review of academic articles, aiming to discern and recognize these factors. Additionally, a relationship has been established between these critical factors and the three dimensions of the AMO model, this is aimed at proposing effective solutions focused on HRM practices to address these challenges.

As SMEs seek to enhance their competitiveness in the market, it is essential for them to grasp the notion of the necessary tools to achieve this goal. In Sabah, Malaysia, knowledge, and implementation of Lean tools are limited in various areas (Adzrie et al. 2020), underscoring the need to provide specific information and knowledge about Lean tailored to SMEs. Furthermore, the main barriers these companies face are a lack of real understanding of Lean Manufacturing as well as unfamiliarity with employee concepts and attitudes (Nordin et al. 2010). Addressing this issue could lead to considerable improvement in Lean implementation, as proper knowledge of tools and programs is essential to reap benefits such as increased productivity, efficiency, customer satisfaction, and reduced production and inventory costs (Zhou 2016). It's also important to highlight that the benefits of Lean also manifest in the development of human capital. The Lean methodology seeks not only the well-being of employees but also the creation of a versatile team capable of performing various tasks with agility. This entails intangible advantages such as team spirit, a culture of innovation, proactive employees, and satisfactory working conditions, as well as the extension of machinery lifespan (Tejeda 2011).

2. Literature Review

In this chapter, scientific articles have been collected with the purpose of providing information that allows for a more comprehensive understanding of the research.

2.1 Lean Manufacturing

Lean is a production methodology that aims to minimize and optimize waste by working on comprehensive value streams to enhance value for customers. Following lean principles, the goal is to transform or eliminate resources that do not contribute value to the consumer (Shah and Patel 2018). It is a comprehensive socio-technological system oriented towards process improvement. Its central objective is to eliminate activities and waste that do not generate value for the customer, resulting in improved quality and reduced production costs and times. This system stands out for employing trained personnel, assigning them specific roles that involve proposing improvements and having the authority to halt production in case of detecting problems. Furthermore, it promotes a mindset focused on achieving a wide range of high-quality products at low cost, establishing enduring relationships with suppliers and customers, driving continuous improvement, and achieving reduced production times (Tejeda 2011).

2.2 The AMO model

This approach establishes a crucial link between human resource management and performance within the organizational context. Its acronym encapsulates the three fundamental dimensions that enhance employee performance: Individual Ability (A), Motivation (M), and Opportunity for participation (O) (Marin and Tomas 2016). This model delves into exploring how practices that constitute a high-performance system contribute to organizations in achieving superior outcomes (Lozano and Sánchez 2019). In Table 1, the definition of the dimensions of the AMO model can be observed(Table 1).

Table 1. Definition of the AMO model

Dimension	Definition
Ability (A)	Refers to the acquired or inherent capacity that enables an individual to successfully perform a task. It encompasses human attributes such as skills, experiences, attitudes, and relevant prior knowledge for task execution (Marin and Tomas 2016).
Motivation (M)	The extent to which an individual desires and chooses to engage in a specified behavior. It can be extrinsic, linked to incentives like economic rewards, or intrinsic, based on the individual's own interests and values (Marin and Tomas 2016).
Opportunity (O)	Refers to the set of circumstances that make something possible. In the context of an employee, this translates to the chance to participate in decision-making processes, exchange knowledge, promote horizontal communication, and enrich the work (Marin and Tomas 2016).

2.3 Lean Manufacturing Tools

Table 2 presents the definitions found in this research for various Lean Manufacturing tools (Table 2):

Table 2. Description of Lean Manufacturing tools

Tools	Description	Source
Six Sigma	Identification and correction of the root causes of errors, thereby reducing the rate to a level of 3.4 defects per million opportunities (DPMO) or 6σ. • Committed top-down leadership	(Kwak and Anbari, 2006: 708-709); (Arnheiter and Maleyef f, 2005: 6-16)
JIT - Just In Time	Synchronize suppliers and processes to significantly reduce waste, based on flow, quality, and employee involvement. • Reduces lead times, inventory levels, and enhances quality. • Provides smooth operations and immediate feedback. Deliver to the customer what they want, in the quantity they want, and exactly how they want it.	(Cuatrecasas, 2006); (Gaither and Frazier, 2000: 516- 537)
Jidoka	Incorporation of systems and devices that provide machines with the ability to detect when errors are occurring. • Manual or automatic halt of the production process based on error detection, to prevent wastage. • Automation with consideration for human involvement. Relationship between people and machinery in charge.	(Hernández and Vizán, 2013:55-58); (Villaseñor and Galindo, 2009: 72)
Kaizen	Culture of sustainable continuous improvement. • Involves the entire organizational structure and has relatively low costs. • Provides leading ways to propose long-term improvements.	(Alukal and Manos, 2006:14-22); (Imai, 2012: 1-14)
Visual Management	A set of communication measures that clearly and simply represent the state of the production system, particularly concerning anomalies and wastage. • Empowers and fosters a sense of belonging among employees. • Delineates areas, materials, products, equipment, production schedules. • Uses indicators.	(Alukal and Manos, 2006); (Hernandez and Vizan, 2013: 52-54)
5S	Comprised of: Seiri (Sorting), Seiton (Set in Order), Seiso (Shine), Seiketsu (Standardize); Shitsuke (Sustain). • Prevents issues arising from disorder and lack of instructions. • Provides well-being, discipline, and a harmonious environment.	(Villaseñor and Galindo, 2009:79); (Rajadell and Sánchez, 2010: 48-66)
SMED - Single Minute Exchange of Dies	A set of techniques aimed at reducing machine setup times. • Standardization through the installation of new mechanisms, templates, and functional fixtures, eliminates adjustment downtime.	(Villaseñor and Galindo, 2009:61-62); (Hernández and Vizán, 2013: 42)
TPM - Total Productive Maintenance	A set of techniques aimed at eliminating breakdowns through the participation and motivation of all employees. • Prevents losses in all company operations. • Maximizes effectiveness and extends the lifespan of equipment.	(Villaseñor and Galindo, 2009:66); (Hernández and Vizán, 2013: 48-52)
Cellular Manufacturing	Work cells designed to produce a family of parts or a limited quantity of part families, enabling a continuous flow by transforming several independently operating processes into a collaborative work cell. • Enhances communication and utilization of personnel and equipment. • Takes into account training, arrangement, and machine sequencing.	(Villaseñor and Galindo, 2009:55), (Chang, Wu, and Wu, 2013: 439 449)
Kanban	A synchronized control and scheduling system of production based on cards, which communicates information about the flow of the product.	(Monden, 1996: 26-30)

Tools	Description	Source
Poka - Yoke	Installation of devices to detect errors, halt production, and alert the operator. • Error-proof, respecting the intelligence of the workers. • Prevents the production of defects through early error detection.	(Villaseñor and Galindo, 2009: 83-85); (Hernández and Vizán, 2013: 55-58)
VSM - Value Stream Mapping	A map specifying the value chain of the organization in both production and managerial areas. • Identifies the flow of processes and waste. • Addresses issues related to communication, personnel, materials, equipment, and processes.	(Sullivan, McDonald, and Van Aken, 2002); (Nash and Poling, 2008: 9-201)
Cycle Cap - Do (Check, Analize, Plan, Do)	It is an adaptation of PDCA (Plan, Do, Check, Act), useful in problem-solving, as it starts with the verification of the object of study to understand it, followed by analysis, then planning, and finally execution.	(Rave et al. 2011:399)
Standardized Work	The working method through which variation, waste, and imbalance are eliminated, performing operations with greater ease, speed, and lower cost, always prioritizing safety and ensuring complete customer satisfaction; always doing the same thing in the same way, obtaining the following benefits: • Quality: Defects decrease while maintaining a consistent level of quality. • Cost: Variation, waste, and operational imbalance can be observed and eliminated. • Compliance: Ensures the delivery of production to the next process by eliminating shortages. • Safety: Reduces accidents by minimizing unsafe acts. • Simplifies personnel learning.	(Correa, 2007:103)
MCD - Manufacturing Cost Deployment	It is a systematic procedure that clarifies the structure and nature of costs related to waste in the manufacturing process. • Enables a specific analysis of the efficiency of the entire production flow. • Allows the development of a cost reduction program. • Improvement projects that eliminate the root causes of the problem.	(Braglia and Gallo, 2019:1826)
TQM - Total Quality Management	A management system based on the principle that personnel must be committed to maintaining high standards of work in all aspects of the business operation.	(Adzrie and Armi, 2021:2)

2.4 Lean implementation process

The implementation of Lean is a process that demands the committed participation of top management, ongoing monitoring with appropriate performance indicators, effective leadership, and proper training to ensure success (León et al. 2017). In studies conducted by Zhou (2016), Jani and Desai (2016), Elkhairi et al. (2019), and Narkhede et al. (2020), challenges faced during the implementation of Lean in various SMEs from different sectors have been identified. Among these challenges, a lack of awareness among staff, economic factors, and a lack of support from top management stand out. This last aspect was mentioned in the research as a crucial element, as it is essential for executives to drive the active participation of all employees to ensure success. These highlighted elements constitute obstacles that can hinder the successful achievement of Lean implementation, collectively referred to as lean barriers.

3. Methods

The investigation was conducted in the form of a systematic literature review. According to Antman and Oxman, a systematic review aims to gather all empirical evidence that meets pre-defined eligibility criteria to address a specific research question. This methodology employs explicit and methodical approaches designed to minimize any bias, to provide reliable results that enable drawing conclusions and making informed decisions (Liberati et al. 2009).

The selection of reviewed studies in this article was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) model, which consists of a checklist comprising 27 quality criteria. This checklist includes elements considered essential for reporting in a systematic review. Additionally, the PRISMA model features a flow diagram that covers four phases: Identification, Screening, Extraction, and Final Selection (Liberati et al. 2009).

Figure 1 shows the approach of collecting academic articles was employed based on the review procedure proposed by Kitchenham (2004):

- Identification of research.
- Selection of studies
- Evaluation of study quality.
- Data extraction.
- Data synthesis (Kitchenham 2004).

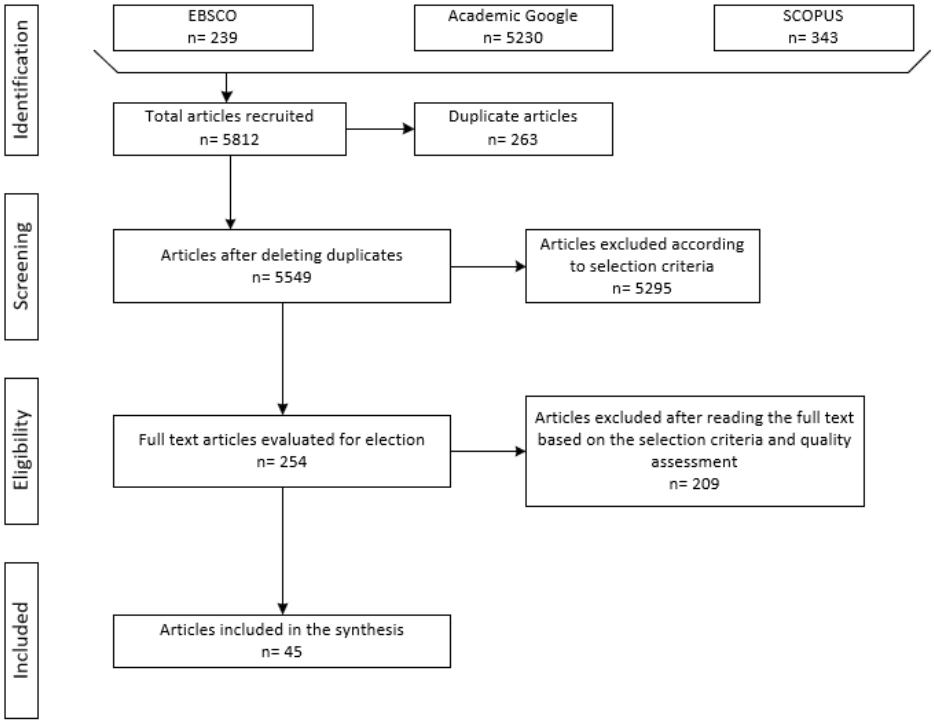

Figure 1. PRISMA review process

With the purpose of addressing the posed questions, an exhaustive search was conducted in the databases of Google Scholar, EBSCO, and SCOPUS. As a result, a compilation of 5,812 academic articles was obtained, which were considered as the study population. Additionally, it is important to note that no geographical restrictions were imposed in this search, as publications from various parts of the world were included, covering the period between 2007 and 2022. It is of utmost importance to consider the terms used during the search for articles in the database, as these could have equivalents in both the language of the initial search and other languages (Petticrew and Roberts 2006).

In the EBSCO, SCOPUS and Google Scholar databases, filters were applied to obtain relevant results and information for the research questions posed. Inclusion criteria were used, initially utilizing the following keywords: Lean Manufacturing, SMEs, Obstacles, and Barriers, within a date range from 2007 to 2022. In total, 45 articles were identified and analyzed that aligned with the study topic, ensuring the relevance and appropriateness of their content. After applying the inclusion and exclusion criteria detailed in the paragraphs above, we were able to gather 45 research studies that address the implementation of Lean Manufacturing methodology in SMEs from various countries. These investigations will provide us with information about the implementation of the lean approach in SMEs and will allow us to collect data on the barriers that emerged during the incorporation of tools associated with this methodology. This

compilation of information will be useful for addressing and providing answers to the questions raised in our research, as well as for contributing to future studies in this field.

The articles chosen through the PRISMA model are of a scientific and rigorous nature. Furthermore, they present an approach that combines both qualitative and quantitative aspects. These articles are classified as theoretical and case studies. Their thematic focus is on the implementation of Lean Manufacturing in the context of SMEs, as well as the obstacles they encountered during the application of this methodology.

4. Data Collection

Through extensive research conducted via a literature review of 45 articles, the main barriers in the implementation of lean tools in SMEs were identified, as detailed in the following Table 3.

Table 3. Frequency of the Lean Barrier

N°	Barriers	Frequency	
1	Lack of understanding	7	15.56 %
2	Lack of financial capacity	5	11.11 %
3	Resistance to change	5	11.11 %
4	Lack of leadership	4	8.89 %
5	Lack of employee attitude	4	8.89 %
6	Lack of top management support	3	6.67 %
7	Lack of managerial attitudes	3	6.67 %
8	Change in corporate culture	2	4.44 %
9	Lack of management knowledge	1	2.22 %
10	Lack of empirical information	1	2.22 %
11	Low investment in human resource development	1	2.22 %
12	Little accessibility to Lean tools	1	2.22 %
13	Company sector	1	2.22 %
14	High implementation time	1	2.22 %
15	Power politics among departments	1	2.22 %
16	Lack of supply chain integration	1	2.22 %
17	High employee turnover	1	2.22 %
18	Human factor	1	2.22 %
19	Adverse Organizational culture	1	2.22 %
20	Poor implementation of Lean tools	1	2.22 %
	Total	**45**	**100** %

5. Results and Discussion

5.1 Numerical Results

According to Table 3, the three most recurrent barriers are led by "Lack of Understanding," with 15.56 %, followed by "Lack of Financial Capacity" and "Resistance to Change," both with 11.11%. These three obstacles stand out as significant challenges in the implementation of Lean in SMEs. Additionally, Table 3 displays a variety of barriers with lower frequencies. This reflects the presence of various challenges and obstacles that can influence the successful

implementation of Lean in different SMEs contexts. This supports what Valente (2020) pointed out regarding the behavior and outcomes during the implementation of lean tools in SMEs. This could be attributed to the fact that by adopting the lean methodology, SMEs may encounter various obstacles due to different factors such as the sector in which the company operates, the lean tools employed, the specific situation of the company, the implementation process, and the adaptation period (Arrascue et al. 2020).

Furthermore, after analyzing the selected articles, 15 case study investigations were found. These investigations detail the implementation of Lean tools in SMEs. Below, Table 4 provides a detailed overview of the SME industries and the applied Lean tools.

Table 4. Analysis of Case Study Articles

Economic Activity	Frequency	Percentage	Used Lean Tools
Textile	3	20.00%	5s, TPM, SMED
Food Industry	2	13.33%	VSM, 5s, Cellular Manufacturing
Furniture Manufacturing	2	13.33%	Six Sigma, 5s, Kaizen
Kitchen Equipment	1	6.67%	VSM, 5s, Standardized Work, TPM
Metalworking	1	6.67%	5s, TPM
Footwear	1	6.67%	VSM, 5s, Kaizen
Railway	1	6.67%	MCD, 5s
Scaffold Manufacturing	1	6.67%	VSM, 5s, SMED, Kaizen
Chemical	1	6.67%	5s
Electronics	1	6.67%	Kaizen, Poka-Yoke, Standardized Work
Tires	1	6.67%	SMED
Total	**15**	**100.00%**	

5.2 Graphical Results

As shown in Figure 2, the most utilized tool, based on the 15 case study articles, is the 5S method, accounting for 37.14%. It is followed by Value Stream Mapping (VSM) at 14.29%, while Total Productive Maintenance (TPM) and Kaizen share the same percentage of 11.43% each.

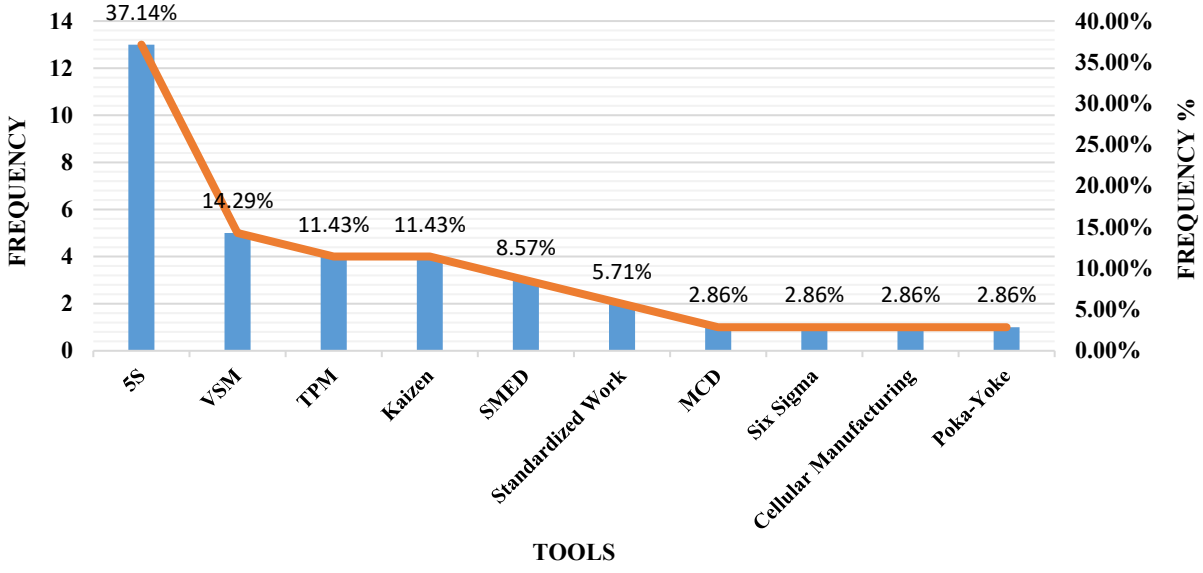

Figure 2. Implemented Tools

5.3 Proposed Improvements

Based on Table 3, we will proceed to analyze the first three barriers, identifying the distinctive critical factors that characterize them according to their level of incidence in the studied articles. Additionally, we will present the AMO model in the context of Human Resource Management (HRM), establishing its relationship with the critical factors of these barriers. This correlation will allow us to provide a solution that effectively prevents and addresses these obstacles. According to the research conducted by Lozano and Sanchez (2019), it can be inferred that the AMO model, contextualized within HRM, has an influence on the outcomes of SMEs. Additionally, Sanz and Gibert (2017) highlight the crucial importance of involving the entire personnel of the company to achieve success in the implementation of the lean methodology. This information is detailed in the following figure.

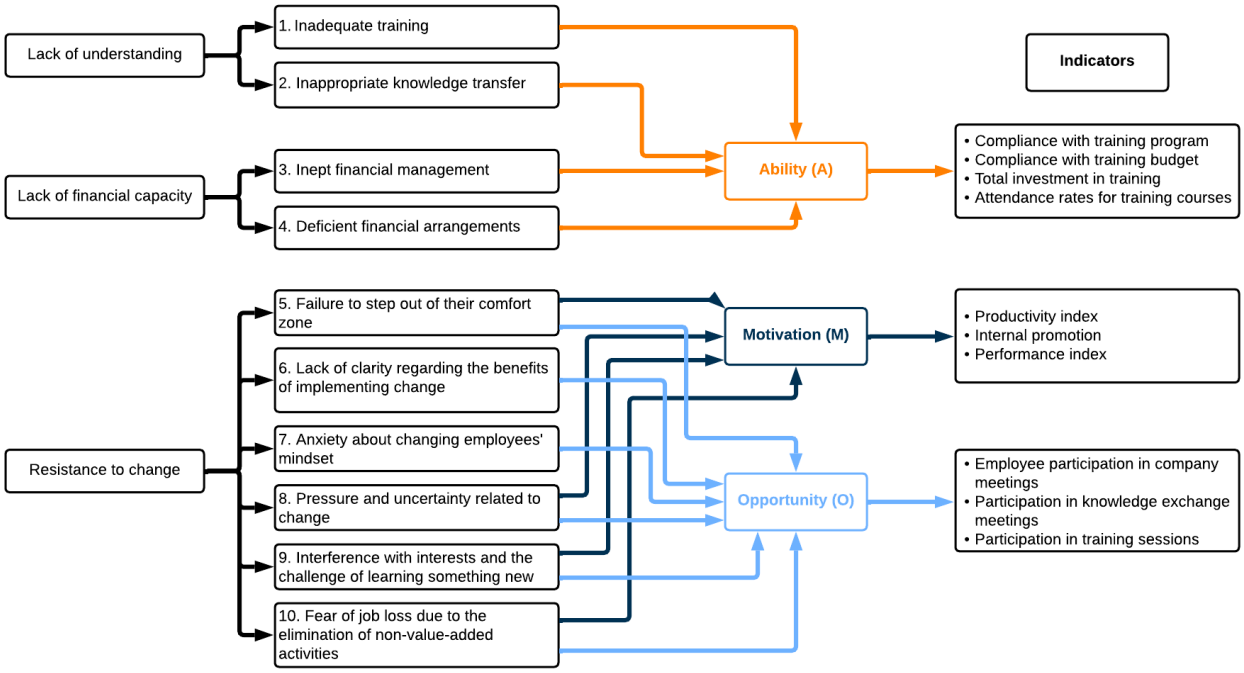

Figure 3. Relationship between Critical Factors of Lean Barriers and the AMO Model

The Ability (A) dimension of the AMO model influences critical factors 1, 2, 3, and 4. Through this dimension, it is possible to address these barriers by providing appropriate training, allowing employees to gain a solid understanding of the methodology. Moreover, to achieve an optimal level of training, it is crucial to conduct proper selection and recruitment for positions, facilitating effective knowledge transfer among employees through training and skill development. Additionally, efficient financial management is required to make relevant investments in SME improvement.

On the other hand, the Motivation (M) and Opportunity (O) dimensions impact factors 5, 8, 9, and 10. These can be tackled by motivating personnel through financial incentives, recognitions, social activities, and promoting work-life balance. Furthermore, offering them the opportunity to participate in company decisions will encourage them to step out of their comfort zones, feel job security, and develop an interest in acquiring new skills that add value to their roles. This will contribute to reducing employee turnover.

Lastly, factors 6 and 7 are influenced by the Opportunity (O) dimension. By encouraging employee participation in company decisions, they can gain a clearer understanding of the challenges the organization faces. This will result in a stronger comprehension of the benefits that come with improvements and the required change in mindset to achieve efficiency and positive outcomes.

After implementing the proposed solution, a set of indicators has been established to facilitate monitoring and evaluation of the improvement progress in relation to the lean barriers. These indicators are presented in Figure 3,

outlining their development according to the identified critical factors. In this way, they can be measured during the execution of the proposed solution model.

5.4 Validation

According to the research conducted by Lozano and Sánchez (2019), it is highlighted that: "The implementation of formalized and properly developed human resource management systems (following the guidelines and orientations of the AMO model) influences the improvement of SMEs' results".

This statement is supported by the results obtained by Lozano and Sánchez in a study carried out in Spain with 1136 SMEs. In this study, it was found that 99.99% of the companies exhibited a high level of competitiveness at an individual level due to the robust implementation of the AMO model, based on its three fundamental pillars:

- Establishment of more rigorous selection systems and implementation of more intensive training programs (Ability).
- Adoption of more formalized employee evaluation systems and introduction of performance-based compensation and incentive plans (Motivation).
- More extensive planning of employees' career development and promotion of their involvement in decision-making (Opportunity) (Lozano and Sánchez 2019).

6. Conclusion

This research highlights various barriers encountered in the implementation of lean methodology in SMEs. The primary obstacle, identified in our study, is the lack of understanding, followed by financial constraints and resistance to change. To address these barriers, it is crucial for all personnel to participate and commit to organizational improvement. For this purpose, the AMO model, focused on HRM, was applied due to the identified relationship between critical barrier factors and the three dimensions of the model. This approach involves implementing rigorous selection systems, intensive training programs, employee assessments, and initiating performance-based compensation and incentive plans. Furthermore, employees' professional development is planned, and their involvement in organizational decision-making is promoted.

To measure the progress of the proposed solution, the following indicators have been established: Compliance with the training program, training budget compliance, total investment in training, attendance rate in training courses, productivity index, internal promotion, performance index, and employee participation in company meetings, knowledge sharing, and training. However, it is important to consider that these indicators may vary depending on the various lean barriers encountered during the implementation of the methodology in SMEs, as each barrier has unique critical factors that characterize it.

The lack of knowledge and understanding constitutes the primary barrier to achieving success in lean implementation. It requires a high level of familiarity with lean methodology and demands a cultural change within the organization. However, effecting this change requires an economic investment, the magnitude of which will depend on the tool being employed. Additionally, due to the time required for benefits to materialize, many companies shy away from implementation. There is also a scarcity of guiding models for SMEs in future implementations.

Literature analysis reveals that several authors, when implementing lean tools, achieve different results and encounter varied barriers due to the unique characteristics and circumstances of each company. Furthermore, an important limitation was identified regarding the limited availability of information on methodological models implemented in SMEs that could serve as a guide for future implementations of lean tools in companies. There is also a lack of research addressing proposed solutions to overcome these lean barriers. This is significant, as this research has confirmed the existence of a considerable number of lean obstacles highlighted by various authors.

This research is designed to assist the organization's top management in understanding the most common barriers and adopting appropriate measures before implementing lean methodology. Furthermore, a solution centered on HRM is proposed due to the need to involve all personnel to achieve success in lean implementation, as demonstrated in this study.

In future research, it is crucial to explore diverse approaches to address these obstacles and highlight the importance of presenting, in a case study, the implementation of the AMO model focused on HRM in comparison to lean barriers.

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