EXAMINING THE ADOPTION OF LEAN MANUFACTURING IN LIMA COMPANIES: AN EXPLORATORY STUDY OF UNIVERSITY THESES

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ABSTRACT

Purpose: The objective of this research was to know the results of the adoption of lean manufacturing in companies in Lima, which were reported in theses for university degrees.

Theoretical framework: The adoption of lean manufacturing is challenging and complex and requires specialized process management due to the various barriers and drivers to adoption.

Design/methodology/approach: The study was conducted using an exploratory and descriptive methodology that consisted of reviewing university theses related to lean manufacturing. Subsequently, companies were identified and contacted by telephone, applying questionnaires with direct questions about adoption results.

Findings: The results were obtained from the review and comparison of university repositories, SUNAT (Superintendencia de administración tributaria) and telephone calls. Descriptive analyses were performed to evaluate the results, which provided insight into the application of the methodology.

Research, Practical & Social implications: It is suggested for future research to explore the adoptions of lean manufacturing proposed in articles of indexed journals to learn about their experiences and adapt them to the national reality.

Originality/value: The results indicate that most of the university theses reviewed only propose the adoption of lean manufacturing and have not been implemented due to the complexity and sustainability of the methodology.

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EXAMINANDO A ADOÇÃO DA MANUFATURA ENXUTA EM EMPRESAS DO LIMA: UM ESTUDO EXPLORATÓRIO DE TESES UNIVERSITÁRIAS

RESUMO

Objetivo: O objetivo desta pesquisa foi conhecer os resultados da adoção da manufatura enxuta em empresas de Lima, que foram relatados em teses de graduação universitária.

Quadro teórico: A adoção da manufatura enxuta é desafiadora e complexa e requer um gerenciamento de processo especializado devido às várias barreiras e aos fatores que levam à adoção.

Projeto/metodologia/abordagem: O estudo foi realizado por meio de uma metodologia exploratória e descritiva que consistiu na revisão de teses universitárias relacionadas à manufatura enxuta. Posteriormente, as empresas

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foram identificadas e contatadas por telefone, aplicando questionários com perguntas diretas sobre os resultados da adoção.

**Conclusões:** Os resultados foram obtidos a partir da revisão e comparação de repositórios universitários, da SUNAT (Superintendencia de administración tributaria) e de ligações telefônicas. Foram realizadas análises descritivas para avaliar os resultados, que forneceram informações sobre a aplicação da metodologia.

**Implicações sociais, práticas e de pesquisa:** Sugere-se que pesquisas futuras explorem as adoções da manufatura enxuta propostas em artigos de revistas indexadas para conhecer suas experiências e adaptá-las à realidade nacional.

**Originalidade/valor:** Os resultados indicam que a maioria das teses universitárias analisadas apenas propõe a adoção da manufatura enxuta e não foi implementada devido à complexidade e à sustentabilidade da metodologia.

**Palavras-chave:** Manufatura Enxuta, Teses Universitárias, Análise Exploratória.

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**EXAMEN DE LA ADOPCIÓN DE LEAN MANUFACTURING EN EMPRESAS DE LIMA: UN ESTUDIO EXPLORATORIO DE TESIS UNIVERSITARIAS**

**RESUMEN**

**Propósito:** El propósito de esta investigación fue conocer los resultados de la adopción de manufactura esbelta en empresas de Lima, que han sido reportados en tesis universitarias de pregrado.

**Marco teórico:** La adopción de la manufactura esbelta es desafiante y compleja y requiere de una gestión especializada de los procesos debido a las diversas barreras e impulsores de la adopción.

**Diseño/metodología/enfoque:** El estudio se realizó mediante una metodología exploratoria y descriptiva consistente en la revisión de tesis universitarias relacionadas con la manufactura esbelta. Posteriormente, se identificaron las empresas y se contactaron telefónicamente, aplicando cuestionarios con preguntas directas sobre los resultados de la adopción.

**Conclusiones:** Los resultados se obtuvieron a partir de la revisión y comparación de repositorios universitarios, SUNAT (Superintendencia de administración tributaria) y llamadas telefônicas. Se realizaron análisis descriptivos para evaluar los resultados, los cuales proporcionaron información sobre la aplicación de la metodología.

**Implicaciones sociales, prácticas y de investigación:** Se sugiere que futuras investigaciones exploren las adopciones de lean manufacturing propuestas en artículos de revistas indexadas para conocer sus experiencias y adaptarlas a la realidad nacional.

**Originalidad/valor:** Los resultados indican que la mayoría de las tesis universitarias analizadas sólo proponen la adopción de lean manufacturing y no han sido implementadas debido a la complejidad y sostenibilidad de la metodología.

**Palabras clave:** Lean Manufacturing, Tesis Universitarias, Análisis Exploratorio.

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**INTRODUCTION**

Lean Manufacturing aims to minimize the waste obtained in the operational processes of the organization, impacting greater profitability and competitiveness. To achieve these results, it focuses on optimizing customer flows and reducing waste in the organization. Lean manufacturing was popularized by Womack through his book "The Machine That Changed the World," after the TPS (Toyota Production System) maximized improvements in the production system. Many authors consider the Lean Manufacture only from a technical point of view, that is, as a toolbox that helps improve performance, some of them being detailed: Heijunka, 5S, Visual Control, Kanban, Kaizen, Andon, Jidoka, and Poka Joke. Each of these tools focuses on different aspects of production, such as logistics, efficiency, continuous improvement, and quality. (Thekkoote, 2022).
Heijunka is a production system that seeks to improve the logistics of the organization to identify the appropriate number of jobs with the required takt time, with a daily, weekly, and monthly periodicity. (Assuad et al., 2020). On the other hand, 5S implies a change in the work philosophy to improve efficiency and reduce waste throughout the manufacturing line and requires continuous monitoring to adhere to the principles of "utilization", "organization", "cleanliness", "standardization" and "discipline". (Mane & Jayadeva, 2015). Visual Control, on the other hand, is a technique that helps workers quickly detect the characteristics or states of the process and its variations, through the use of signals, signs, role registration, progress measurement, and improvements in interdepartmental communication (Saurin et al., 2013).

Kanban, another tool of Lean Manufacturing, is a production flow regulation system that optimizes inventories of finished and in-process products, contributing to the development of pull systems at workstations (Herrera et al., 2019). Kaizen is a discipline focused on continuous improvement and is considered a philosophy that promotes the perfection of processes, based on personal and work values, increased competitiveness, commitment and efficiency, and improvement of workflows (Herrera et al., 2019).

Andon: It is a visual control technique that uses lights to inform workers in real time about the progress of their tasks. If a problem is detected, an alert is generated and production is halted until it is resolved. This helps to make decisions based on up-to-date information, improve results and planning, and allow control of objectives. (Tanudiharjo et al., 2021). Jidoka: This method, devised by the founder of the Toyota group (Sakichi Toyoda), verifies the quality of each production process through self-control mechanisms. These automatically detect defects and stop the process to resolve them and determine their origin. The goal is to increase productivity, improve production quality, ensure on-time deliveries, and reduce costs and waste. (Saurin et al., 2021). Finally, Poka-yoke: It is a human error detection technique that aims to prevent the formation of defects and strengthen the quality, avoiding rework and increasing customer satisfaction.

For the adoption of Lean Manufacturing, it is necessary to have a guide and be prepared to face change. This will empower the entire team and ensure that the process is successful. In this way, the productivity and competitiveness of the organization can be improved, which will result in greater profitability and stability in the market. This process of adopting lean manufacturing can prove challenging for many organizations, many managers and workers don't understand lean manufacturing tools (Sarjiman et al., 2023) and it requires a radical change in the work culture and approach of the system. However, despite this, many companies seek to adopt this methodology due to its importance in improving productivity and achieving...
stability in the market. (Cuggia-Jiménez et al., 2020). Its adoption in organizations in the region is not largely documented in scientific research journals lacking valid information to analyze experiences. Therefore, it is essential to explore other means that allow the experiences of the adoptions of lean manufacturers and that have been evaluated by the scientific method such as university theses.

Research is exploratory descriptive because it is used to explore new topics by identifying patterns and trends providing a basis for further research. (Kothari, 2004) based on the review and verification of the university degree theses that have as their theme lean manufacturing of the universities of Lima and that have open access in their repository similar to the studies carried out by (García, 2008; Repiso et al., 2013; Soto, 2018), To verify the implementation of lean manufacturing, the companies that were the objects of study were contacted.

**THEORETICAL FRAMEWORK**

Companies face an ever-changing market environment, which brings with them challenges in both technology and management. To be competitive, it is essential to produce with quality, reduce costs and innovate in products and services, among other improvement initiatives. (Negrão et al., 2017). In this sense, we can detail accelerators in the adoption of lean manufacturing as:

**Leadership:** is an important pillar for achieving desired success in implementing lean manufacturing that is defined as one of the key responsibilities of leaders in a lean organization is to effectively direct both processes and people at every stage of planning, ensuring that the organization is on track to achieve its vision of meeting the product attributes required by customers. (Shamsudin & Velmurugan, 2023; Yadav et al., 2017).

**Commitment to management:** Senior management must understand the magnitude and complexity of implementing a lean methodology, as well as the benefits this brings to the organization so that there is a real commitment to the process. In this sense, it is important to empower leaders, allowing them to make decisions about the development of operations and facilitate a fast and efficient flow of information, from the operational to the tactical levels and from these to the strategic. In addition, management must ensure the training of leaders responsible for directing processes, through specific courses designed to provide in-depth knowledge of the tools to be applied. (AlKahtani et al., 2019)
Training: Training and monitoring are key elements in the lean manufacturing adoption process and must be led by strategic levels to ensure its sustainable implementation in the organization. Often, responsibility for this training is delegated to external trainers, consultants, or quality departments without proper training. It is important that training is conducted in the workplace and led by subject matter experts, and that managers take responsibility for ensuring that the knowledge gained is perennial and sustainable in the organization. (Santos Bento & Tontini, 2018)

In addition to accelerators, it is important to highlight the barriers that can hinder the success of lean manufacturing adoption. (León et al., 2017). Table 1 details the main forces that can act as barriers in this process.

Table 1. Barriers to lean manufacturing adoption

<table>
<thead>
<tr>
<th>BARRIERS</th>
<th>FEATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient time and availability for</td>
<td>Time is required to plan the work to be done in the implementation</td>
</tr>
<tr>
<td>implementation</td>
<td></td>
</tr>
<tr>
<td>Insufficient financial resources</td>
<td>Indispensable for implementing lean manufacturing</td>
</tr>
<tr>
<td>Poor understanding of tools and techniques</td>
<td>Low level of advice to understand the benefits of lean manufacturing</td>
</tr>
<tr>
<td>Inadequate implementation planning</td>
<td>Not knowing the techniques of Lean Manufacturing generates that there is bad planning.</td>
</tr>
<tr>
<td>Lack of management support</td>
<td>Little involvement by company managers</td>
</tr>
<tr>
<td>Resistance to change</td>
<td>Some workers are reluctant to change their processes</td>
</tr>
<tr>
<td>Difficulty in identifying process parameters</td>
<td>Processes requiring improvement are not identified</td>
</tr>
<tr>
<td>Poor measurement of customer satisfaction</td>
<td>No existe o falta de control en cuanto a la opinión del cliente respecto al producto o servicio</td>
</tr>
<tr>
<td>Difficulty sustaining improvements</td>
<td>Little initiative in improving processes or services</td>
</tr>
<tr>
<td>Uncertainty of results</td>
<td>This factor manifests the problems of intangibility of the Lean Manufacturing results.</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors (2023).

The complexity of the adoption of lean manufacturing projects is influenced by barriers and accelerators that affect the little literature of application in scientific articles in the region that forces to explore the adoption in research reports of university degree theses in the main universities of Lima contacting by telephone with the object of study and knowing if the implementation was successful or only a proposal.
MATERIAL AND METHODOLOGY

Research takes an exploratory and descriptive approach (Hernandez et al., 2003; Mastana, 2023) since there is no verifiable information on the implementation and results of lean manufacturing projects presented in university theses. In this way, it seeks to determine if the proposals have been translated into practice and how the barriers and accelerators involved have been faced. The sample was selected for convenience due to the complexity of obtaining information from the companies involved in the study. (León et al., 2017)

For the development of the research, a thesis search was carried out for undergraduate and graduate degrees at the universities of Lima. The thesis repositories of the Universidad Nacional Mayor de San Marcos (UNMSM); Pontificia Universidad Católica del Perú (PUCP); Universidad Privada del Norte (UPN); At last; at the Universidad Cesar Vallejo (UCV) with the keyword "Lean manufacturing".

The contacts with the companies were telephone through the information they have on their websites, social networks, and in the tax administration (SUNAT) to verify if the companies are active and comply with their tax obligations at the time the investigation is carried out. The exploration of theses to analyze results is developed in the research of (García, 2008; Repiso et al., 2013; Soto, 2018): The instrument was a questionnaire with 2 questions: 1) Was the project of adoption of lean manufacturing to obtain the thesis to obtain an academic degree of your knowledge? 2) Was the lean manufacturing adoption project successfully implemented or was it just a proposal? He avoided asking more questions because of companies' reluctance to share information. The methodology is detailed in Figure 1.
Figure 1 Methodology design

<table>
<thead>
<tr>
<th>Methods</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database (Repositories)</td>
<td>Undergraduate and postgraduate thesis. Universities: UNI, UNMSM, UNFV, UCV, PUCP – Lima</td>
</tr>
<tr>
<td>Periods – Keywords</td>
<td>The period is due from 2015-2021, due to the possibility that those responsible for the thesis projects continue working. The keywords are: Lean Manufacturing</td>
</tr>
<tr>
<td>Open Access Repository Search</td>
<td>Universities are excluded: UNI, UNFV</td>
</tr>
<tr>
<td>Database</td>
<td>It is considered Thesis that includes the references of the company (Spatial dimension)</td>
</tr>
<tr>
<td>First telephone contact</td>
<td>Theses that do not contain company data are excluded</td>
</tr>
<tr>
<td>Excludes companies without information or data</td>
<td>The person in charge of the company is contacted and asked about the thesis project, stating that it is an anonymous investigation that seeks only to know the results of the project</td>
</tr>
<tr>
<td>Database</td>
<td>Companies that do not answer or are not interested or otherwise are classified and excluded.</td>
</tr>
<tr>
<td>Contact is made with the company (object of study)</td>
<td>The classification of the works is: a) Contacted and interested b) Non-interested contacted c) Contacted without answers d) Projects not recognized by the company e) Liquidated Companies f) Company with official leave g) Company do not exist</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors (2023).
RESULTS AND DISCUSSION

The selected universities are located in Lima and whose identified theses have as a line of research the lean manufacture and at the same time is free to access virtually, according to the table and figure 2.

<table>
<thead>
<tr>
<th>University</th>
<th>Number of Thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNMSM</td>
<td>78</td>
</tr>
<tr>
<td>PUCP</td>
<td>24</td>
</tr>
<tr>
<td>UPN</td>
<td>5</td>
</tr>
<tr>
<td>UCV</td>
<td>38</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors (2023).

Figure 2 Thesis results with lean manufacturing topics.

Source: Prepared by the authors (2023).

Figure 3 Research results – The thesis includes the name of the company.

Source: Prepared by the authors (2023).
Examining the Adoption of Lean Manufacturing in Lima Companies: An Exploratory Study of University Theses

It is critical to understand that lean manufacturing is not simply a set of tools that add value to products, but a culture of continuous improvement that involves a radical and challenging process. However, despite numerous attempts to implement the system, even by organizations with the best intentions, many of these measures have failed. It is important to note that, most companies focus solely on the application of tools and techniques to solve short-term problems or to obtain quick results, neglecting the true essence of the philosophy. In this way, the main problem in the adoption of this methodology lies in the lack of understanding of the fundamental purpose of the transition to the lean manufacturing system.

As for the theses explored, most are SMEs due to the nature of these organizations and the barriers that arise hinder their implementation. (Choudhary et al., 2019). Financial, human resource, and operational management constraints make the adoption of lean manufacturing very complex, which requires a conviction at the managerial level to ensure its sustainability.

In addition, it is important to note that thesis students are often in tactical and operational positions, which limits their authority to implement process improvement projects, which in
turn hinders the adoption of lean manufacturing. In most theses, lean manufacturing is addressed only from the theoretical point of view, and very few are implemented in practice.

CONCLUSION

The theses that have included the object of study in the title of the university theses were reviewed, but many thesis students do not include the name due to confidentiality requirements. It was found that 56% of the theses do have the information. Most of the university theses related to lean manufacturing are linked to the manufacturing and services sector due to the application characteristics of this concept.

Of the companies analyzed, only 12% mentioned having implemented the lean manufacturing project, which corroborated with the head of the organization. On the other hand, it was found that 17.8% of the thesis only proposes the application of lean manufacturing, and that has not been implemented, which limits the ability to contrast the results.

It is important to mention that many small and medium-sized businesses are reluctant to share information and do not respond about the adoption of lean manufacturing. In addition, 5.9% of the companies that were explored do not exist, which means that the theses carried out were simulated.

Finally, it was identified that some companies have paralyzed their activities due to the complexity of the health emergency environment, which has caused them to close due to a lack of competitiveness.

In conclusion, most of the theses on lean manufacturing are theoretical proposals and there is little evidence of its application in business reality.

REFERENCES


