

Systematic Literature Review of the application of Lean methodologies in the retail sector

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Abstract

Currently in business, the retail sector faces a number of problems such as poor or weak business management, presence of waste, presence of high inventories, problems with customer service, inefficiency in the work line, among others. This research raises the question: What research has been done in the retail sector to know how Lean tools could help solve their current problems? The type of research that has been chosen is of documentary design and for its development has been used the systematic literature review of twenty-six (26) articles published between 2000 and 2020, selected on the basis of keywords and which apply the philosophy of Lean manufacturing in the retail sector. The results show that the application of the Lean methodology allows for better business management, cost reduction, increased productivity, improved customer service, reduced inventories and shorter delivery times.

Keywords

Retail, Lean-Retailing, literature review, Lean tools, Waste reduction

1. Introduction

Wholesalers and retailers are the link between manufacturers and end consumers. The fluctuating demand of the latter prompt the former to become more flexible and adjust their supply chain strategy while finding a way to save costs, promote sales and add value. (Daine *et al.* 2011)

In pre-pandemic years – according to Conexión ESAN (2019), Peruvian retail businesses lacked sufficient storage space for their products due to the supply exponential growth back then. On the other hand, product delivery and distribution had problems, and this generated a drop in productivity and competitiveness for the businesses in this sector (Conexión ESAN, 2018).

Product warehouse distribution was also a problem caused by several reasons such as an absence of inventory management policies, poor physical warehouse organization, poor use of warehouse space, a lack of tech support, little training for warehouse employees and poor distribution route scheduling (Conexión ESAN, 2018).

Likewise, retail customers in Peru try to find retribution for their brand loyalty by getting product discounts, reward programs, direct access to store platforms, ensuring an optimal delivery of their purchase (Conexión ESAN, 2016), *as well as an optimal after-sales and sales service with a credit card* (Aguilar *et al.* 2019).

Higueras (2019) states that businesses in the retail sector will face important challenges in the next 10 years through disruptive changes in their business models and growth strategies and will adopt Lean thinking as their way to adapt in this new scenario (Daine *et al.* 2011).

Moreover, since 2020 first quarter, fast-developing, unprecedented, large-scale COVID-19 has caused a global crisis entailing the need for a change to protect people, making companies react and people change attitudes and behaviors. According to BBC News (2021), over the first few months of this crisis, the stock indices such as FTSE from London, Dow Jones Industrial Average from the United States and Nikkei from the Japanese market experienced drastic falls as the number of COVID-19 cases increased. Likewise, the IMF estimates that the world economy shrank 4,4% in 2020 which they have described as the worst crash since the 1930's Great Depression. However, this need to respond to change will not end when the virus immediate threat is gone (Accenture, 2020). Essential businesses in this new reality, such as convenience stores, drugstores, and electronics retailers have faced an increasing consumer demand while continuously adapting to health precautions and restrictions by the government (Harriman *et al.*, 2020).

Furthermore, technology development has become a key success factor in today's retail industry despite the fact that today's global economy is dragging through recession (Guerrero-Martínez 2012) raising many questions about the future of retail trade. As a pioneer of digital transformation, retail trade has already adapted to the consumer needs and transcended into e-commerce and mobile commerce (Ivanova, 2020).

The term Lean Retail was introduced in 1999 by Abernathy *et al.* based on previous research on Lean Thinking by James Womack and Daniel Jones (1996). This research found Lean practices as an important trend in the different stages of the retail sector: sales, purchase tracking, inventory, and supply chain management.

The concept of Lean Production was conceived by Krafcik (1988) while doing some studies for the International Motor Vehicle Program of the Massachusetts Institute of Technology (MIT). This research covered 90 vehicle factories in over 20 countries where manufacturing processes quality, availability, and productivity rates were compared. Subsequently, these concepts were developed by Womack *et al.* (1990) in their book 'The machine that changed the world' which was renamed as 'Lean Manufacturing'. Later on, Womack and Jones adapted this methodology for a more general application in their 1996 publication called Lean Thinking.

Womack and Jones (1996) propose the Lean Thinking concept as a methodology intended for continuous improvement while reducing costs, increasing productivity, and attaining efficiency and final quality. The five ground principles they propose are:

- Define value: It is the criteria defined by the customer to find a good or service valuable, and the supplier is to decipher and discover said criteria.

- Map the value stream: This includes the activities to transform raw materials into finished products, the activities to enable the flow of information, and the managerial activities for attaining processes objectives and continuous improvement.
- Create flow: In other words, to minimize waste focusing on eliminating those activities that add no value to the process as well as optimizing the use of production resources.
- Establish pull: Products are made when requested by the end user as to avoid overproduction.
- Pursue perfection: it entails the pursue of compliance of all quality standards, zero defects, as well as detection and solution of problems from the source.

The Lean concept is based on the elimination of different types of waste generated in the manufacturing process. (Hines *et al.*, 2004). Ohno (1988) states seven types of waste – overproduction, over-processing, transportation, unnecessary waiting time, inventory management, workers moving excessively, and making defective products / services.

The Lean tools include continuous processes for analysis, improvement, pull production, flawless process management, and discipline. The main tools are:

- Value Stream Mapping (VSM) is a graphic and visual representation of a process where all five critical steps are identified, processing time and volume are measured for each stage of the process. This representation shows the flow of materials and information from the customer to the suppliers (Wang *et al.* 2005).
- Visual Management is a process management strategy where different sign- and color-coded tools are applied on processes in order to make workers quickly aware of the information needed to be conveyed (Baird, 2013).
- 5S is a tool created to maintain the workspace clean and tidy and is the base of Lean philosophy (Rivera *et al.* 2007).
- Jidoka is a Lean manufacturing principle that ensures compliance of quality specifications in a production process. It is mainly known from Toyota's production system and was developed by Shingeo Shingo, a Japanese industrial designer from the XX century. Its three main tools are Poka Yoke, Andon and the Self-Quality Matrix (Siva *et al.* 2017).
- Kanban is a technique used to control the production line work, so it remains aligned to internal or external customer demands. It is associated with the Just-In-Time Management system. This technique was created by Toyota and it means 'information card' in Spanish (Karwasz and Skuza 2019).
- Just in Time (JIT) is a production management system approach used for inventory minimization where only what the internal or external customer demand requires is acquired or produced (Shah *et al.* 2017).

From all the aforesaid, the purpose of this research was to look into research about Lean methodology implementation intended as an operational problem solution before and after COVID-19 pandemic. The governing question of this research is: Is there any research in the retail sector to know how Lean tools could help solve their current problems?

2. Methodology

In this research, of a documentary approach, literature was reviewed systematically in three different stages – first review planning; second, review by selecting or summarizing academic work or research; and finally, preparation of results and discussion of contributions found. (Tranfield *et al.* 2003).

In order to start this research, a bibliographic search in Scopus database was conducted. First, the key words 'Lean Retailing' and 'literature review' were used in the title, summary and key-word search boxes but no published paper was found. However, a second search was done using the key words 'Lean' and 'literature review' in the title, summary and key-word search boxes and 135 scientific papers were found for review, most of them in business & accounting and engineering with 74 and 72 bibliographic documents, respectively. In addition to this, the other literature reviews that were found focused on decision making, computer science, and environmental science with 41, 25, and 17 documents correspondingly. Finally, fields like power, medicine, social sciences, mathematics, and earth and planetary sciences have 12 or fewer studies each.

Since no prior studies on systematic Lean Retailing literature review were found, we proposed to do the first research about it. To do this, the first search was limited to papers published in indexed journals from 2000 to 2020 in Scopus,

Web of Science, Scientific Electronic Library Online (SciELO), Red de revistas Científicas de América Latina y el Caribe, España y Portugal (Redalyc), Dialnet, and Directory of Open Access Journals (DOAJ). Dates were chosen as to ensure up-to-date results that can be relevant in the context of this research.

Search was conducted in carefully selected journals in categories related to operations management or industrial engineering as these fields are ideal or relevant for this research.

The words 'Lean' and 'Retail' were browsed in the databases under paper title, summary and key-word search categories. These words refer to the continuous improvement methods applied in Retail businesses. A total of 46 documents were found throughout the consulted databases.

Each paper was first assessed by the research team members as to select those papers specifically discussing the application of this type of tools to improve retail operations and not others. Finally, a total of twenty-six (26) papers were selected for the study.

Papers were reviewed noting the following questions:

- *What is the scientific production in the topic?*
- *What Lean tools are present in the research?*
- *What stage of the value chain was/were the Lean tool(s) applied at?*
- *What is the scope, approach, and methodology design applied?*
- *What problems of the Retail sector could be solved with Lean tools?*
- *What are the benefits of the Lean method in the Retail sector?*

For paper selection the following criteria were used:

- Studies conducted in industrial engineering-related contexts and other economy-related specialties.
- Studies conducted in retail businesses anywhere in the world.
- Papers written in Spanish and English.
- Full-text papers from online peer-reviewed journals.
- Papers published between 2000 and 2020.

Dissertations or research papers for a degree qualification or academic title were excluded for these sources were not peer-reviewed. Excel dynamic tables were used to assess each paper by organizing and standardizing information managed upon categories and sub-categories. The table 1 includes said categories and sub-categories:

Table 1. Literature review categories

Category	Sub-category
Scientific Production on the topic	<ul style="list-style-type: none"> • Number of papers per year • Academic Journals where the paper is published. • The authors of the papers. • References • Number of times one of the papers is quoted by others.
Lean tools and continuous improvement concepts	<ul style="list-style-type: none"> • Lean Principles • 7 wastes • Value Stream Mapping (VSM) • 5S • Visual Management • Poka yoke • JIT • Kanban • Six Sigma (DMAIC)
What stage of the value chain were the tools applied at?	<ul style="list-style-type: none"> • Procurement/inbound logistics • Operations/process logistics • Marketing/sales

	<ul style="list-style-type: none"> • Outbound logistics/transportation • After-sales/customer service • Warehouse/inventory • Technology/communications • Finance/accounting • Innovation/ human resources
Scope of research	<ul style="list-style-type: none"> • Exploratory • Descriptive • Correlational • Causal explanatory
Research approach	<ul style="list-style-type: none"> • Quantitative • Qualitative • Mixed
Methodological design	<ul style="list-style-type: none"> • Experimental • Survey design • Case study • Ethnographic • Action research • Theory-based • Others
Retail sector problems that were solved by applying Lean tools	<ul style="list-style-type: none"> • Bad or poor business management • Waste • High inventory levels • Customer service • Inefficient line
Benefits of applying Lean tools in the Retail sector.	<ul style="list-style-type: none"> • Improved business management • Cost reduction (higher productivity) • Improved customer service • Inventory reduction • Others (lead time reduction)

Own elaboration

3. Results

3.1 Scientific Production on the topic

The search of scientific production on Lean Retail resulted in 26 papers between 2000 and 2020, which described how the method was applied and/or the results expected to be attained. 60.71 % of the studies are between 2015-2020. The figure 1 shows the results per year.

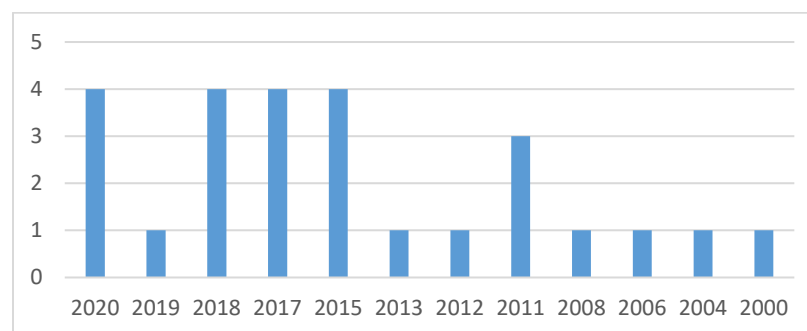


Figure 1. Number of papers per year

22 research results were found in 20 different academic journals and the other 4 publications are from conferences. The table 2 is a list of the journals where the papers were published.

Table 2. Number of papers per journal

Name of journal	Number of papers
International Journal of Retail & Distribution Management.	2
VNU Journal of Science: Economics and Business	2
Advances in Intelligent Systems and Computing	1
Assembly Automation	1
International Journal of Applied Engineering Research	1
International Journal of Business Innovation and Research	1
International Journal of Logistics Systems and Management	1
International Journal of Operations and Production Management	1
International Journal of Production Economics	1
International Journal of Services and Operations Management	1
International Review of Management and Marketing	1
Journal of Marketing Development and Competitiveness	1
Journal of Purchasing and Supply Management	1
Manufacturing Letters	1
New Technology, Work and Employment	1
Proceedings of the International Conference on Industrial Engineering and Operations Management	1
Production and operations management	1
Technology and Health Care	1
Technology in Society	1
Waste Management	1
Total	22

Own elaboration

As for the authors, there are **76 authors** in all 26 papers combined; 30.76% of the papers were written by 3 authors and 30.76% were written by 4 authors. There is a single paper written by a single author. As for the authors' academic affiliation, 23 papers indicate they are affiliated to universities, and only 3 papers show they are affiliated to research schools, centers or institutes. The figure 2 shows the number of papers according to number of authors.

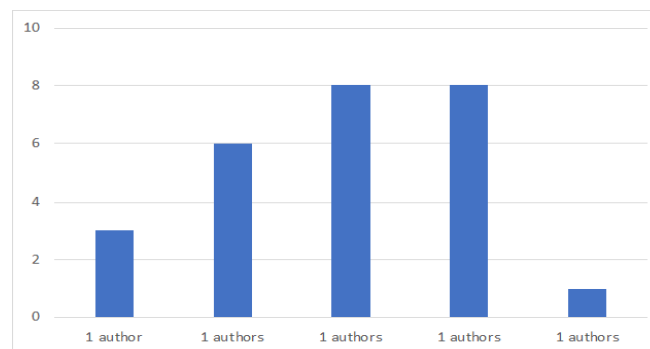


Figure 2. Number of papers according to number of authors

Across the 26 papers, 816 references were found and assessed by the research team. The most quoted research was written by Womack and Jones called 'Lean Thinking' in 1996 and re-edited in 2003, which was quoted 11 times. Second most quoted book is 'The Machine that Changed the World' by Womack *et al.* (1990) and quoted 9 times.

‘The Toyota Way: 14 Management Principles form the World’s Greatest Manufacturer’ written by Liker (2004) is the third most quoted book with four quotes. Ohno (1988) write ‘Toyota Production System: Beyond Large-Scale Production’ was quoted 3 times.

Additionally, we can mention other 28 papers that repeat twice. These publications include topics such as Lean (16), retail (10) and supply chain (11). Out of 28 scientific papers, 9 discuss two topics at the same time. On the other hand, there are other 784 references that are quoted only once. The table 3 includes the papers analyzed and the number of times they were quoted in another publication.

Table 3. Papers and the number of times they were quoted in other papers

Paper	Number of times they were quoted in another paper (according to the databases)	Number of times they were quoted in another paper (according to Google Scholar)
Retailing and supply chains in the information age	51	185
Lean versus green: The impact of Lean logistics on greenhouse gas emissions in consumer goods supply chains	46	79
Lean thinking with improvement teams in retail distribution: a case study	5	62
Improved service system design using Six Sigma DMAIC for a major US consumer electronics and appliance retailer	25	60
Part-feeding with supermarket in assembly systems: Transportation mode selection model and multi-scenario analysis	29	34
The Effects of Application of Lean Concept in Retail	6	19
Operational Leanness and retail firm performance since 1980	9	18
Storage allocation framework for designing Lean buffers in forward-reserve model: a test case	10	14
Six sigma tools in integrating internal operations of a retail pharmacy: a case study	9	12
Transition from push to pull in the wholesale/retail sector: Lessons to be learned from Lean	7	9
Integration of Lean Operation and Pricing Strategy in Retail	0	9
Examining the Link between Retailer Inventory Leanness and Operational Efficiency: Moderating Roles of Firm Size and Demand Uncertainty	5	8
Improving the carbon footprint of food and packaging waste management in a supermarket of the Italian retail sector	4	7
Macro and micro logistics aspects in defining the parts feeding policy in a mixed-model assembly system	7	7
Assessment of Retail Practices for Providing Enhanced Value-Added Services and Improved Customer Satisfaction Using Lean Manufacturing Approach	4	6
Lean Production Practices to Enhance Organizational Performance	5	5
A novel model for benchmarking the performance of retail stores for retail operations using Lean manufacturing approach	4	5
HATS project for Lean and smart global logistic: A shipping company case study	0	3
Development and implementation of dashboards for operational monitoring using participatory design in a Lean context	2	3
Design of facility layout with Lean service and market basket analysis method to simplification of service process in the supermarket	2	2
Modeling a retail distribution warehouse to reduce truck unloading times	2	2
A survey of apparel retailer's satisfaction	1	1
Lean Management Model in Retail Business the Case of Supermarkets in Hanoi	1	1
Productivity improvement through Lean initiatives- a service sector case study in India	0	1
Product returns: a growing problem for business, society and environment	0	1
Lean warehousing: A case study in a retail hypermarket	0	1

Own elaboration

3.2 Lean tools and continuous improvement concepts

In the twenty-six (26) papers, we found the most applied or studied tools / concepts were 'Lean Principles' (nine times) while '7 Wastes', 'Value Stream Mapping', and 'JIT' were quoted eight times each. This proves that these tools are the most widespread. The figure 3 shows the applications of lean tools.

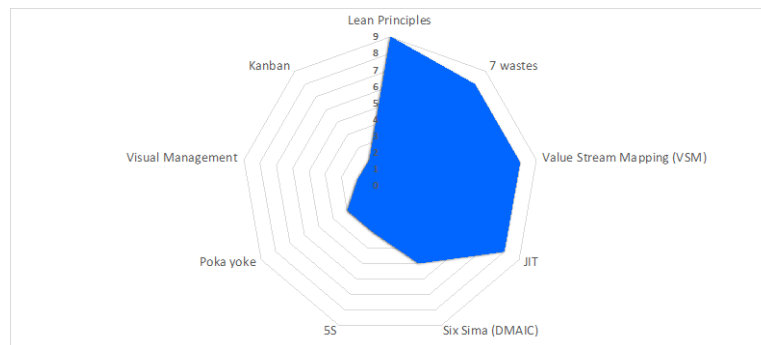


Figure 3. Application of lean tools

3.3 What stage of the value chain were the tools applied at?

From the literature reviewed, we can assert that Lean tools are mostly applied in marketing and sales, outbound logistics (distribution), and storage and inventory which is consistent with retail business key processes (Pride *et al.* 2018). The figure 4 shows the number of papers that have considered applying the tools at some of the value chain stages:

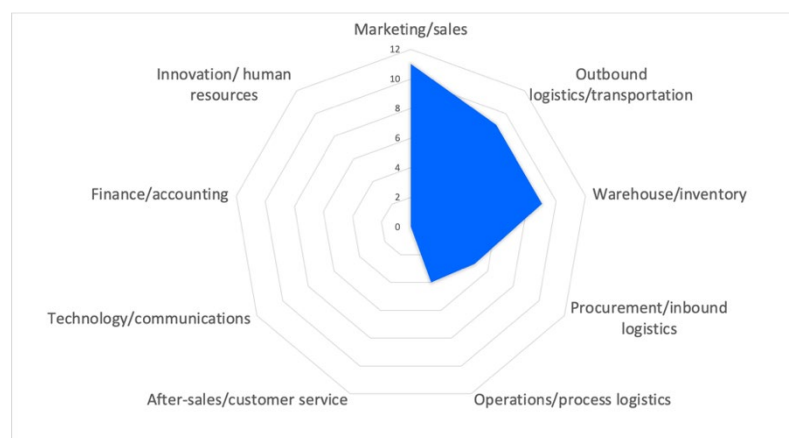


Figure 4. Stages of the value chain

3.4 Scope of research

As for the scope of the papers reviewed, most of them are correlation-based where the relation degree is measured between two or more variables, such as customer service time, degree of satisfaction, loading and unloading times, after-sales service time, level of sales and inventory accuracy. The figure 5 shows the scope of research.

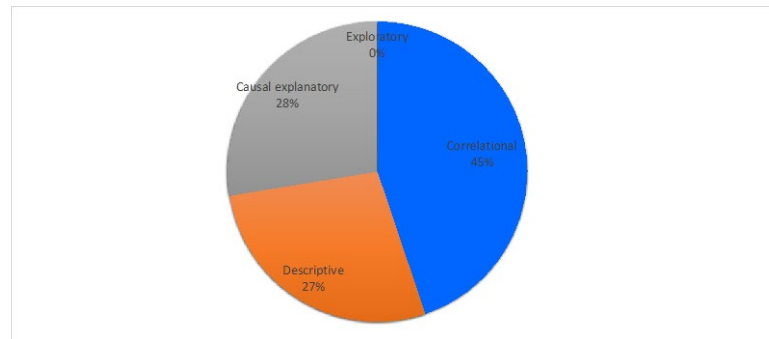


Figure 5. Scope of research

3.5 Research approach and Methodological design

Out of the twenty-six papers reviewed, 50% have a qualitative approach, i.e., they follow an inductive logic from specific (Lean tools) to general (benefits in the retail industry). As for the method design, 75% of the papers reviewed use case studies. Case study is a method strategy recommended when in-depth analysis of a unit is required (Hernández *et al.* 2013). The unit analyzed in the paper herein is businesses of the retail sector. The figure 6 shows the research and method design applied.

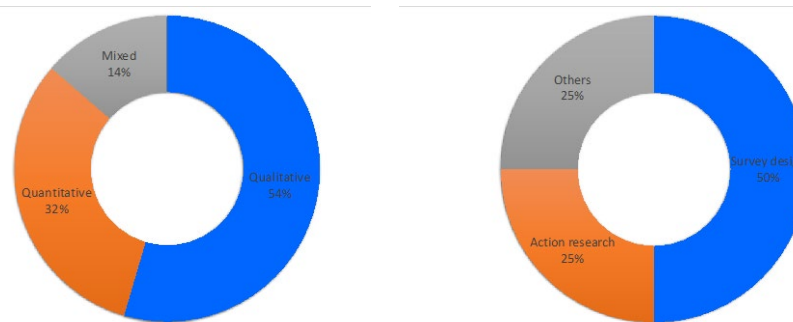


Figure 6. Research approach and method design applied.

3.6 Retail sector problems that were solved by applying Lean tools and benefits of applying Lean tools in the retail sector

Finally, problems and benefits of applying the Lean methodology are displayed in parallel. The main problem to be solved is associated with an 'improved business management', 'reduction of inventories', and 'elimination of waste' which is consistent with the main assets of a retail business: brand and inventory (Pride *et al.* 2018). The figure 7 shows the Retail-related problems that were solved and benefits of applying lean tools in the retail sector.

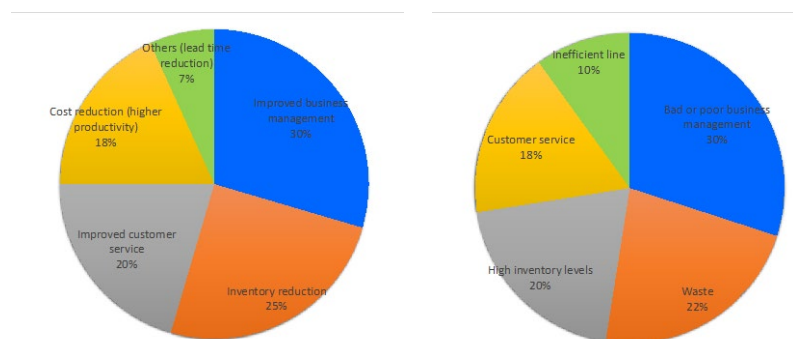


Figure 7. Retail-related problems that were solved and benefits of applying lean tools in the retail sector.

4. Discussion

In the papers reviewed, Lean tools and continuous improvement concepts have been proposed with different approaches and have been applied at some of the stages of the value chain of retail businesses with favorable results. Most of the results from the papers reviewed suggest applying tools such as JIT, VSM, Kaizen, 5S, and Poka Yoke.

Lean Principles of streamlining processes, reducing waste, and increasing productivity are valuable and applicable to retail operations, especially where efficient in-bound and out-bound logistics processes are of paramount importance. However, managers ought to avoid taking a myopic view of lean retailing, as reduction of inventory holdings is not synonymous with improvement of operational efficiency. Taken together, the associations of company size and demand uncertainty discussed above appear to be useful. (Chuang *et al.*, 2019)

The use of a Lean Principles, and in particular the value stream on identifying waste and its causes, was highly effective in quickly identifying a number of opportunities for improvement within company's value chain. Lean philosophies can be used to transform the strategies to address the problems related to inventory, obsolescence, long lead times and distribution in the supply chain (Daine *et al.*, 2011; Shah and Khanzode, 2017; Kroes *et al.*, 2018). On the other hand, Bashir *et al.* (2020) shows in the warehouses of a hypermarket the savings in shipping cycle time by 16% and a reduction in labor cost by 25% by applying lean manufacturing principles and focusing on seven wastes.

In the same way, JIT has a great impact on general performance (quality, speed, reliability, flexibility, and cost); Poka-Yoke plays a critical role in performance as it helps prevent and eliminate quality defects whereas Kaizen and 5S have a moderate impact on general performance (quality and speed). Lean helps deliver products and services faster at a lower cost and inventory (Shah *et al.* 2017; Maher y Das, 2013). According to Kumar and Kwong (2011), evidence that the application of Six Sigma tools is quite effective in streamlining and integrating the process flow in a pharmacy's customer service. Additionally, it's essential worker's participation in lean projects to increase their motivation, to assure an increase in productivity and process efficiency (Jaca *et al.*, 2012).

These are some results from applying lean tools: Bashir *et al.* (2020) labor cost reduction in 25% for a supermarket chain; Sperdelozzi *et al.* (2006) unloading time reduced in about 46% for a retail distribution warehouse; Jaca *et al.* (2012) an increased productivity from 9.06% to 9.96% in the distribution center warehouses; Vignesh *et al.* (2016) and Andrés-López *et al.* (2015) provide advantageous financial results and excellent customer satisfaction for businesses in the services industry. According to research conducted, in practice quantitative effects of lean thinking in retail are sales increasing (up to 10 %), labor costs reduction (between 10% to 20%), inventory reduction (Between 10% to 30 %) and stock-outs (between 20% to 75 %). This significantly affects customer satisfaction and profitability. (Lukic, 2012).

Abernathy *et al.* (1999), the most quoted author, proposes applying Lean techniques in the retail sector through a simple work organization – the pull system – to drive replenishment and eliminate bottlenecks and waste across the supply chain to improve overall retail performance. Another example presented by the same author, is the change that Lean retailing entails, which is forcing apparel manufacturers to rethink the way they interact with their retailing customers, undertake distribution, forecast and plan production, and manage their relationship with suppliers.

It is worth noting that the literature reviewed does not include any research in Latin America. All papers are based on Asia, Europe or North America. However, Maher and Das (2013) state there are no sufficient Lean tools as effective as to improve their relationship with retailers. Both of them are opportunities for future research.

5. Conclusion

The question proposed in the research herein is proven through the literature review since the businesses in the cases studied undertook Lean Retailing as work philosophy and attained a better business management, reduced costs, an increased productivity, a better customer service, a reduced inventory and delivery time, among others.

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