



## APPLICATION OF LEAN OFFICE: OPPORTUNITIES AND TRENDS

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**Abstract.** The Lean philosophy proposes to eliminate waste, removing processes that do not add value to the production flow. This philosophy, which originated in the automobile sector, has embodied other sectors and it has been applied in the administration of the business, in addition to the manufacturing environment. The Lean Office emerged as a result of the companies' quest to become increasingly leaner, which is based on the application of Lean Manufacturing principles and tools in the administrative activities of organizations. This paper aims to analyze the literature on Lean Office (LO) seeking new opportunities and trends for simplifying and accelerating its implementation. For this, a systematic literature review (SLR) was carried out over a period of 10 years (July/2010 to July/2021) identifying the main most cited authors, most relevant journals, and the main research topics, as well as trends of its implementation. A sample of 28 articles was selected based on the criteria adopted by SLR, obtaining 15 main elements identified for developing and maintaining of the LO, and it was possible to understand better the current status of its implementation. This study presents an academic contribution about LO from the point of view of elements within to the process and its trends. For professionals, it presents LO factors that add positive results to organizational learning processes, and the possible impact on society of helping the company managers to direct better their efforts. The conclusion is that there is a great opportunity to apply LO in organizations, and there is still a lot of work to be done in order to develop a robust body of knowledge in lean of the administrative processes.

**Keywords:** Lean office, difficulties, systematic literature review, administrative process, lean management.

### 1 Introduction

Organizations have been looking for solutions to improve their operational performance and their manufacturing practices since the demands of consumers and competition in market have increased. In order to survive in this fierce competitive scenario, companies need to meet the demands of their consumers, who expect better products and services increasingly in terms of price and quality, offered at the right time; in addition to

the demands of other stakeholders, who generally expect companies to be more committed to ethics, to human beings and to the environment, using fewer resources and providing more assertive organizational spaces with leaner processes [1]; [2].

Ensuring competitiveness is a highly demanding task because organizations are facing an entirely new context led by the economic globalization, crisis phenomena, increased competition, innovation of services and processes and greater emphasis on time to market [3], in addition to the pandemic from 2020, which globally affected the labor, the organizational and commercial relations of companies in general. As stated by Groshen [4], the pace of employment recovery has decelerated significantly since June/2020. This probably reflects less business reopenings, along with growing recessive influences (from bankruptcies, defaults and cautious behavior by consumers, state and local governments, companies and investors). The recessions tend to accelerate the pace of structural changes in response to new technologies, commercial pressures, and consumption trends [4].

In order to increase production using the least possible resources, reducing physical effort and the use of equipment, time, movement and space to add value to the product, there is the Lean philosophy, which proposes to eliminate waste, removing processes that do not add value to the production flow. Lean is a process improvement philosophy modeled on the Toyota Production System (TPS) developed by Toyota in Japan from 1950, and later, it was known as Lean Manufacturing, described by Taiichi Ohno (1988), [5], [6] and [7].

Lean Manufacturing had been developed and it is composed of philosophical principles (4P's - Philosophy, Process, People and Partners, Problem solving), tools and, mainly, based on practices that have been tested and adjusted over several years, reaching the Toyota Production System House with well-defined and interconnected foundations (standardization and kaizen), pillars (JIT and JIDOKA) and roofs (quality, cost, lead time) [8] and [9].

Womack and Jones [7] defined 5 principles of the Lean philosophy: defining value, mapping the value stream, creating a continuous flow, organizing a pull flow, and seek for perfection. Therefore, lean practices have been increasingly implemented by companies in order to improve the operational performance of companies, based on the 4P's and the 5 Lean principles [10]; [11]. Thus, experiencing the philosophy of Lean Manufacturing is one of the most impactful long-term strategies that work and have the potential to identify, to reduce and to eliminate waste [12], as well as costs and improvement of customer satisfaction [13].

In summary, the objective of Lean Manufacturing is to carry out the work as efficiently and quickly as possible, through continuous improvement (CI) of the value stream, sequencing of activities, reduction of deadlines, elimination of waste and increase of process flexibility [14], which enables the possibility of applying its principles and tools in other areas besides the productive sector of a company, such as the administrative sector.

The application of Lean concepts in administrative areas, that is, non-manufacturing areas, is called Lean Office (LO). The LO concept emerged from Lean Manufacturing, which is "[...] a way to specify value, line up on the best sequence of the actions that create value, perform these activities without interruption whenever someone requests

and to perform them optimally increasingly effective” [5]. Therefore, LO consists of adapting Lean practices to administrative areas [15], with the objective of reducing or eliminating waste in administrative processes and in information flows [16], [17].

An eight-step roadmap was proposed by Tapping and Shuker [15] for implementation of the LO, as a guide to promote and to sustain “lean” improvements in administrative areas.

This paper aims to analyze the literature on Lean Office (LO) seeking new opportunities and trends for simplifying and accelerating its implementation.

The article is structured in five sections: section 2 presents the theoretical foundation about Lean Manufacturing, LO and its applications, as well as the benefits of its implementation. Section 3 describes the research method adopted: SLR. Section 4 presents the results and the discussion of the main aspects of the research, the section 5 is highlighted regarding the findings and trends, and then, finishing in section 6 with the conclusions.

## **2 From Lean Manufacturing to Lean Office**

Lean Manufacturing means ending with the waste in operations, tasks, time, energy, money, and materials in organizations, so that quality and employee commitment are improved in all departments. According to Womack [6], it provides a way to get more done with less human effort, less equipment, less time, and less space – while getting close to provide customers exactly what they want.

There are some phases that are significant in Lean implementation in a company, such as: specifying value and identifying value stream, pull and perfection [6].

According to Freitas and Freitas [18], value refers to a good or a service for final customers. Value stream is the set of activities for delivering value. Flow means that the activities of the value stream must be uninterrupted. Pull (the production) means that a demand is necessary to carry out any value stream activity. Perfection refers to seeking a continuous improvement (CI). The widespread concept of lean management is a systematic approach to identify and eliminate waste, defined as activities without added value, through continuous improvement.

In the recent past, lean practices were also adapted to the administrative area, resulting in the Lean Office (or Lean Administrative Sector), which is based on Lean Manufacturing principles adapted to administrative processes with the objective of reducing and eliminating the flow of information and knowledge. It is commonly used when the concepts of lean thinking are applied to non-manufacturing and physical activities, regarding the value stream, the flow of information and knowledge. It is estimated that 60% to 80% of all costs associated with meeting a customer’s demand are related to administrative processes [15]. This illustrates why it is essential to recognize the importance of these administrative areas and to optimize these processes as well.

The main difference between lean production and lean management is that in lean production the processes and outputs of these processes are highly visible, as they consist of physical flows and products. Instead, administrative processes and results are

predominantly intangible, like information flows. Therefore, tasks and roles of administration are not often well-defined [19].

Table 1 presents a comparison between manufacturing and office activities, based on the basic principles of Lean Manufacturing.

**Table 1 :** Comparison between manufacturing and office about the value

<b>BASIC PRINCIPLES</b>	<b>MANUFACTURING</b>	<b>ADMINISTRATIVE OFFICE</b>
VALUE	Visible at every step; set goal	Hard to view; changing goals
VALUE STREAM	Items, materials, components.	Information and knowledge
MAKE IT FLOW	Interaction is waste	Planned interactions must be efficient
LET THE CUSTOMER PULL	Guided by Takt-Time	Guided by the company's needs
PERFECTION	Allows the repetition of processes without errors	The process enables organizational improvement

Source: McMANUS [20].

Since LO consists of adapting Lean practices to administrative areas [15], it focuses on organizational activities that create value for the final consumer, with the objective of reducing or eliminating waste in processes and information flows [16]; [14]; [16]; [17]; [21]; [15]. Bodin [14] discusses further that the LO characterizes offices in which there is support and facilitation to boost the efficiency of lean work processes.

Evidence of the benefits of lean is widely reported in the literature [22], but the application of the Lean approach in office areas still needs further studies to reach more agile and simplified roadmap or framework.

Based on the studies by Yokoyama [23], it was identified 28 articles that presented the main segments in which LO initiatives were implemented, as shown in Table 2.

**Table 2.** Main segments with LO implementation

<b>Main Segments</b>	<b>Author(year)</b>
General manufacturing	Chen and Cox (2012), Sabur and Simatupang (2015), Monteiro et al. (2017), Besser Freitag et al. (2018), Sastre et al. (2018), Demeter and Losonci (2019), Sum et al. (2019), Fuchs et al. (2020), Sousa and Dinis-Carvalho (2021).
Public administration	Goncalves et al. (2015), de Almeida et al. (2017)

Services (health, education, hotel services, engineering, accounting, research, management, laboratories, consulting, technology)

Transport, communications, and electric, gas and sanitary services

No organization studied or not described  
(theoretical study)

Knight C. (2010), Seraphim, Da Silva, Agostinho (2010), Nieuwenhuis et al. (2014), da Silva et al. (2015), Cavaglieri and Juliani (2016), Carneiro et al. (2017), Magalhaes et al. (2019).

Monteiro et al. (2015),

Kuriger et al. (2010), Mirehei et al. (2011), Bodin (2013), Rüttimann, Fischer, and Stöckli. (2014), Näftänäilä and Mocanu (2014a), Näftänäilä and Mocanu (2014b), Näftänäilä and Mocanu (2014c), Freitas et al. (2018), Yokoyama et al. (2019), Freitas and Freitas (2020).

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Source: adapted from Yokoyama [23].

Regarding the segments of application presented in Table 2, the distribution of studies is as follows: 10 articles are theoretical works, and 18 articles are with practical applications. The distribution of Lean Office implementation from these 18 articles is as follows: 8 in general manufacturing, 2 in public administration, 7 in services, and 1 in transport, communications, and in electricity, gas and sanitary services. In this study Yokoyama [23] it was sought to identify the main difficulties in implementing the LO, and it was verified that the term LO started to be present in publications from 2005.

## 2.1 Benefits of Lean Office

Almeida [24] mentioned as benefits of the Lean Office approach that it reduces the production of printed documents, decreases the time needed to provide services, restricts the excessive movement of people between sections, improves the use of underused human resources, reduces the number of hierarchical levels, and minimizes document storage costs [25].

McKellen [26] presented the typical benefits of implementing LO, and they were summarized by Gonçalves [27], as shown in Table 3.

**Table 3.** Summary of typical benefits of implementing LO

Benefits	Examples
Effective communication through visual management	use of updated and organized murals, as well as electronic dissemination of information
Efficient use of space	elimination of physical file storage areas, as well as the use of online file storage
Reduction in the amount of processed paper	reduction and elimination of printed e-mails for future reference, as well as reducing the number of copies



Formalization of document crossing systems	implementation of standard operating procedures
Reduction of meeting time	early and efficient communication of necessary meetings, which begins and end on time
Elimination of internal computer notifications	verification of online data and external terminals
Motivation of the people	use of empowerment.
Reduction of crossing time	identification and elimination of delays between departments, as well as elimination of excessive approvals for purchasing office supplies and equipment

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Source: Gonçalves [27].

By eliminating office waste, the typical benefits of a lean office implementation are improved workflow, improved productivity, reduced lead time, reduced costs, and improved customer satisfaction.

In addition, there is a better use of the work space, reduction of bureaucracy, improvement in communication through implementing visual management and standardized procedures, optimizing acquisition approval strategies, fewer meetings, reducing the rework, supplying real time information, improving the quality of products and services, engaged workers, improving the work teams well-being and more motivated and skilled employees [26]; [21]; [23].

## 2.2 Method of application proposed by Tapping and Shuker (2010)

In order to implement the LO, Tapping and Shuker [15] propose a method which contains eight steps, detailed in Figure 3.

Based on Ohno [28] and Freitas [29], it is more difficult to apply Lean concepts to administrative areas than to manufacturing environments, because of a lack of comprehension, a lack of cooperation between departments, and a lack of guidance from leaders [30], presenting a new view on office waste revealing problems in information management, workflows, layout and availability of equipment, materials, and tools.

**Figure 3:** Method for planning, mapping, and sustaining Lean improvements in administrative areas (LO).

Commitment with <i>Lean</i>	senior management, as well as all employees, must support the <i>Lean</i> transformation effort to reduce and to eliminate waste;
Choice of value stream :	choosing the value stream (final customer) in order to observe also the previous and subsequent processes that will be impacted, in addition to the individual process;
Learning about Lean:	the process of learning about Lean differs for each organization, with the need of explaining about lean concepts and tools to employees;
VSM Current Status:	visual representation of the material flow through symbols or icons and information flow of a specific value stream;
Identifying Lean performance measures:	to determine Lean metrics that are effective and easy to understand and to collect the data;
VSM future status:	to analyze in a critic way the current status map in order to troubleshoot the detected VSM current status problems;
Creating Kaizen plans:	to improve a value stream or a process, in order to increase its added value by reducing waste;
Implementing kaizen plans:	to implement Kaizen plans through three steps: preparation, implementation and follow-up.

Source: Elaborated by the authors - Lean Office methodology developed by Tapping; Shuker [15].

In Table 4, there is information about the Tapping and Shuker method regarding the number of quotes of works that used this method and in which sectors they were applied.

**Table 4.** Main authors and sectors that cited the method of Tapping and Shuker [15].

<b>Main Segments</b>	<b>Number of citations</b>	<b>Author(year)</b>
Services (health, education, hotel services, engineering, accounting, research, management, laboratories, consulting, technology)	6	Knight C. (2010), Seraphim, Da Silva, Agostinho (2010), da Silva et al. (2015), Cavaglieri and Juliani (2016), Carneiro et al. (2017), Magalhaes et al. (2019).
General manufacturing	5	Chen and Cox (2012), Besser Freitag et al. (2018), Sastre et al. (2018), Fuchs et al. (2020), Sum et al. (2020).
Public administration	2	Goncalves et al. (2015), de Almeida et al. (2017).
Transport, communications, and electric, gas and sanitary services	1	Monteiro et al. (2015).
No organization studied or not described (theoretical study)	6	Kuriger et al. (2010), Bodin (2013), Năftănăilă and Mocanu (2014a), Freitas et al. (2018), Yokoyama et al. (2019), Freitas and Freitas (2020).

Source: adapted from Yokoyama et al. (2019).

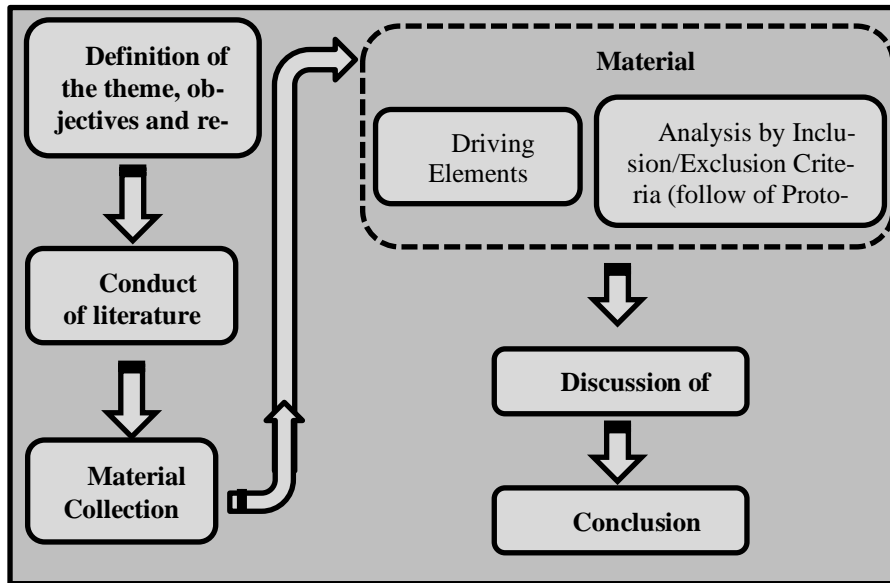
Of the 28 articles, the roadmap by Tapping and Shuker [15] is not cited by the following works: Rüttimann, Fischer, and Stöckli. [31], Sabur and Simatupang [32], Demeter and Losonci [33], Mirehei [34], Monteiro [35], Năftănăilă and Mocanu [36], Năftănăilă and Mocanu [37], Sousa and Dinis-Carvalho [38] and Fuchs [39].



### 3 Research Method

The research method adopted followed the methodological flow shown in Figure 4.

**Figure 4: Methodological Flow.**



Source: adapted from Nunhes, Bernardo and De Oliveira [40].

The steps of this methodological flow will be detailed below.

#### 3.1 Definition of the theme, objective and research method

The first step to perform the research was the establishment of the necessary key elements for elaborating the project, such as the definition of the theme aiming its relevance and originality, objective, delimitation, and justification.

From this, the authors defined the objective of the study, which is to establish through a systematic literature review and focusing on the 28 most cited articles from June/2010 to July/2021, which contains the theme of LO in terms of analyzing its literature seeking new opportunities and trends for simplifying and accelerating its implementation.

To develop this work, the chosen research method was the systematic review of the literature (SLR), which according to Ramy [41] the reflections of the literature allow to minimize and to create starting points for future advances in theory and practice. Jesson, Matherson and Lacey [42] state that SLR is a method that allows researchers to identify, to evaluate and to interpret all research already available and relevant to a particular subject area. Hood and Wilson [43] state that it is an analysis method used to describe the study of the science, which includes growth, structure, interrelationships, and productivity of a certain research theme, and according to Al-Tabbaa and Ankrah [44]

SLR has been adopted increasingly in the management field, since it is a reliable and rigorous process that reduces subjective bias and the risk of neglecting relevant research.

According to the criteria adopted by SLR in the sample of 28 articles, 15 driving elements were obtained, identified for developing and maintaining the LO, as well as to understand better the current status of its implementation.

### 3.2 Conduct of literature review

The conduction of the SLR occurred from the elaboration of the research protocol (Figure 5) which performs the planning of the guiding elements, strategies and criteria used in the execution of the researched material collection. The protocols are adopted as indicated by Kitchenham [45] and Tranfield [46] to ensure the rigor and reliability of the SLR. In this research protocol, the combinations of terms (search strings) were specified to identify with more assertiveness the articles to be included in the set that will be analyzed.

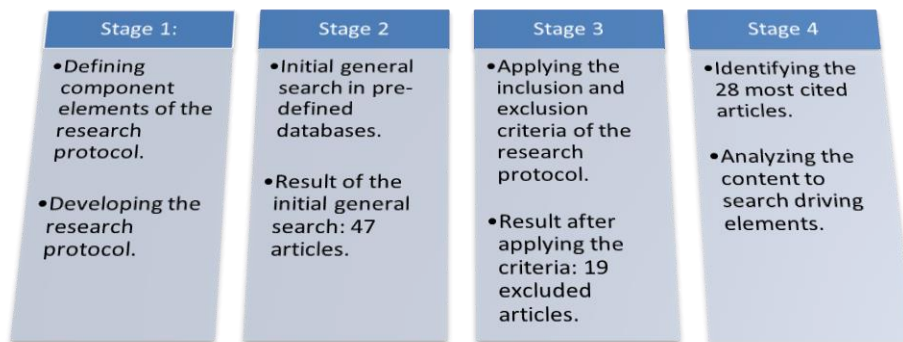
**Figure 5.** SLR Research Protocol

1) Background	Overview of the latest LO implementation.
2) Research Questions	<ul style="list-style-type: none"> <li>I. What are the main practices of the Lean Office application?</li> <li>II. What are the indicators and/or tools used to measure Lean Office performance?</li> <li>III. Are there standards for Lean Office implementation?</li> <li>IV. What are the findings and trends regarding Lean Office implementation?</li> </ul>
3) Research Strategies	Database: Scopus and Web of Science
4) Keywords and combinations	<i>("Lean Office" and "Public Administration"; "Lean Office" and "Public Service"; "Lean Office" and "roadmap" or "framework" or "application"; "Lean Office")</i>
5) Exclusion Criteria	<ul style="list-style-type: none"> <li>I. Articles that are not peer-reviewed;</li> <li>II. Articles that are not published in periodicals;</li> <li>III. Articles published after the pre-established period from 2010 to July/2021;</li> <li>IV. Articles that were not published in the languages: English or Portuguese;</li> <li>V. To delete duplicate articles, and which don't have related purpose.</li> </ul>
6) Inclusion Criteria	<ul style="list-style-type: none"> <li>1. Articles identified by the "snowball" process;</li> <li>2. Among the authors selected by the "snowball" process, the possible inclusion of articles will be evaluated, if there is a link between the subjects;</li> <li>3. Articles published in the pre-established period from 2010 to July/2021;</li> </ul>
7) Strategy for data organization	<ul style="list-style-type: none"> <li>I. Use of MS Excel® and Bibliometrix® Software;</li> </ul>

Source: Elaborated by the authors themselves.

Figure 6 defines four stages of execution of the SLR process, which are substeps of the methodological flow (Figure 4), and Stage 1 is inserted in the Conduction of literature review, and it establishes the component elements of the research protocol in addition to the research protocol itself with its seven requirements to be met during the search process of articles in the databases.

**Figure 6:** Stages of the SLR process



Source: Elaborated by the authors themselves.

### 3.3 Material collection

In the second stage of Figure 6, there is the substep of the methodological flow (Figure 4): Material collection, which is an initial general search in pre-defined databases using only the keywords and their combinations (search strings) openly. This initial general search resulted in a set of 47 articles.

### 3.4 Material evaluation

In the third stage of Figure 6, there is the initial part of the substep of the methodological flow (Figure 4): Material evaluation, which applies the inclusion and exclusion criteria on the set of 47 articles found in the initial general search (stage 2).

There was a filtering of the most relevant articles to the topic presented from the application of the inclusion and exclusion criteria provided in the SLR research protocol and with an expanded analysis of each article by reading/interpreting the titles and abstracts, which include the introduction, results, and conclusion sections, consequently, 19 articles had been excluded since they were out of the scope of this research. Then, at the end of stage 3, a new set of 28 articles was reached for the full effective analysis.

In the fourth stage of Figure 6, there is the final part of the substep of the methodological flow (Figure 4): Material evaluation, which identifies the ranking of citations in this new set of 28 articles since they adhere to the researched topic. It was adopted the

criterion of analysis of the most cited articles to contribute to the development of the state of the art in the LO area, as they are interesting sources already referenced in other researches, providing fundamental aspects of content. Afterwards, an analysis of the content of each of these most cited articles is carried out to search elements that drive LO applications. The content analysis identifies how often categories of a particular subject are approached in an article. This varies for each study, depending on the researcher's assumptions and the nature of the research [47]. LO elements were identified in the new set of 28 articles, verifying the frequency that they are cited (Table 7). The literature on content analysis suggests that only researchers have the capacity to understand, analyze and evaluate the results obtained in an adequate way. Otherwise, the inclusion of external participants to the research to verify and to analyze the results could threaten its validity. Dialogue between co-researchers is often recommended when it comes to qualitative content analysis [48]; [49]. Thus, the identification of elements was developed with the participation of the authors of this article, who have extensive research experience in Lean Manufacturing and LO.

#### **4 Results and discussion**

Initially, an overview of the main aspects found during stage 4 is presented (Figure 6): i) Table 5 with the most published periodical; ii) Table 6 with the 28 most cited articles in LO in the period from 2011 to June/2021; iii) Table 7 with the 15 main elements for applying the LO; and iv) Figure 7 the radar chart representing the frequency in which each one of the 15 main elements were approached in the 28 most cited articles.

Table 5 shows the periodicals that most published about the topic in this set of 28 most cited articles, and it is observed that, according to the criterion for citation, it is highlighted the articles by Da Silva [50] with 13 citations, Almeida [24] with 10 citations, followed by Freitas and Freitas [18] with 3 citations, which are the three publications of the International Journal of Lean Six Sigma. Da Silva et al. [50] present management techniques in the health sector through the lean office. However, Almeida [24] investigate the necessary adjustments for planning and implementing the LO in a Brazilian regulatory agency. Finally, Freitas and Freitas [18] reveal significant benefits related to improvement of information management in contexts of lean office implementation.

The second most published periodical- Quality - Access to Success - also had 3 publications by the authors Năftănăilă and Mocanu [21], Năftănăilă and Mocanu [36], and Năftănăilă and Mocanu [37]. Năftănăilă and Mocanu [21], this article is the first of three parts that the authors approach the 5S methodology, starting with the basic principles and finishing with an application of a personal perspective. Năftănăilă and Mocanu [36], this article is the second part of the three, in which it was studied the lean tools applied in the administrative area, with the emphasis on the most powerful and important tool for the administrative area, which is the value stream mapping (VSM), in this article. Năftănăilă and Mocanu [37] presented the concept of lean at the management level, about team building, describing four stages of team development.



**Table 5.** Periodicals that the most published on the topic in a set of 28 articles.

<b>Periodicals</b>	<b>Number of publications</b>
International Journal of Lean Six Sigma	3
Quality - Access to Success	3
Espacios	2
Production Planning and Control	2
American Journal of Industrial and Business Management	1
Brazilian Journal of Operations and Production Management	1
FME Transactions	1
Gestão e Produção	1
IEEE Transactions on Engineering Management	1
Industrial Engineering and Management Systems	1
International Journal for Quality Research	1
International Journal of Learning and Intellectual Capital	1
International Journal of Services and Operations Management	1
Journal of Corporate Real Estate	1
Journal of Experimental Psychology	1
Journal of Experimental Psychology: Applied	1
Journal of Organizational Change Management	1
Journal of Service Science and Management	1
Perspectivas em Ciência da Informação	1
Procedia Manufacturing	1
RISTI - Revista Ibérica de Sistemas e Tecnologias de Informação	1
Simulation and Gaming	1
<b>Total</b>	<b>28</b>

Source: elaborated by the authors

Table 6 shows the 28 most cited articles selected in the period, and this citation analysis demonstrates the number of times that the work was cited over time, which proves that they are relevant research and already referenced by other works, as well as favoring and being useful for getting to the state of the art in the LO area.

**Table 6.** The 28 most cited articles in LO from 2011 to 2021

N.	Title	Author(s)/Year	Times cited	Journal	ISSN
1	The Relative Merits of Lean, Enriched, and Empowered Offices: An Experimental Examination of the Impact of Workspace Management Strategies on Well-Being and Productivity	Knight and Haslam (2010)	66	Journal of Experimental Psychology	1076898X
2	The relative benefits of green versus lean office space: Three field experiments	Nieuwenhuis et al. (2014)	63	Journal of Experimental Psychology: Applied	1076898X
3	Value stream management for lean office-a case study	Chen and Cox (2012)	24	American Journal of Industrial and Business Management	2164-5167
4	A web-based lean simulation game for office operations: Training the other side of a lean enterprise	Kuriger et al. (2010)	17	Simulation and Gaming	1552826X
5	Leveraging lean in the office: Lean office needs a novel and differentiated approach	Rüttmann, Fischer, and Stöckli. (2014)	15	Journal of Service Science and Management	1940-9907
6	An explorative review of the Lean office concept	Bodin Danielsson (2013)	14	Journal of Corporate Real Estate	1463001X
7	Lean office in health organization in the Brazilian army	da Silva et al. (2015)	13	International Journal of Lean Six Sigma	20404166
8	Improvement of customer response time using Lean Office	Sabur and Simatupang (2015)	11	International Journal of Services and Operations Management	17442370
9	Transferring lean knowledge within multinational networks	Demeter and Losonci (2019)	11	Production Planning and Control	9537287
10	Implementing lean office: A successful case in public sector	Monteiro et al. (2015)	10	FME Transactions	14512092
11	Lean thinking: planning and implementation in the public sector	de Almeida et al. (2017)	10	International Journal of Lean Six Sigma	20404166
12	Lean Office contributions for organizational learning	Freitas et al. (2018)	10	Journal of Organizational Change Management	9534814
13	Enhancing lean training for the office environment through simulation and gaming	Mirehei et al. (2011)	6	International Journal of Learning and Intellectual Capital	14794853
14	Processes improvement applying Lean Office tools in a logistic department of a car multimedia components company	Monteiro et al. (2017)	5	Procedia Manufacturing	23519789
15	Lean office in health military organizations: Case study in the health center of Campinas	Seraphim, Da Silva, Agostinho (2010)	4	Gestao e Producao	0104530X
16	Lean office (Linoff) 1. 5S methodology	Näätäniemi and Mocanu (2014a)	4	Quality - Access to Success	15822559
17	Lean Office (Linoff) 2. Value Stream Mapping	Näätäniemi and Mocanu (2014b)	3	Quality - Access to Success	15822559
18	Improving processes in a postgraduate office of a university through lean office tools	Magalhaes et al. (2019)	3	International Journal for Quality Research	18006450
19	Information management in lean office deployment contexts	Freitas and Freitas (2020)	3	International Journal of Lean Six Sigma	20404166
20	Lean Archives: The use of lean Office in archive management	Cavaglieri and Juliani (2016)	2	Perspectivas em Ciencia da Informacao	14139936
21	Lean Office And Digital Transformation: A Case Study In A Services Company	Besser Freitag et al. (2018)	1	Brazilian Journal of Operations & Production Management	22378960
22	Proposed use of Lean Office in reducing call time on products of the project analysis of polo industrial Manaus	Carneiro et al. (2017)	2	Espacios	7981015
23	Lean Office (Linoff): 3. Team dynamics and lean assessment	Näätäniemi and Mocanu (2014c)	1	Quality - Access to Success	15822559
24	Lean Office: Concept Applicability Study on a Federal Public University]	Goncalves et al. (2015)	1	Espacios	7981015
25	A systematic literature review on lean office	Yokoyama et al. (2019)	1	Industrial Engineering and Management Systems	15987248
26	Analysis of the Implementation of a Lean Service in a Shared Service Center: A Study of Stability and Capacity	Sum et al. (2020)	1	IEEE Transactions on Engineering Management	189391
27	A game for process mapping in office and knowledge work	Sousa and Dinis-Carvalho (2021)	1	Production Planning and Control	9537287
28	Proposal to improve the maintenance management plan based on rcm and lean office in the polymer injection process	Fuchs et al. (2020)	0	RISTI - Revista Iberica de Sistemas e Tecnologias de Informacao	16469895

Source: elaborated by the authors.

In this study, the 28 most cited articles were the ones that most spread their contributions in the literature on LO (together they add up to more than 300 citations). For this reason, the results of these articles had a significant impact on the development of the state of the art in the LO area.

By eliminating office waste, the typical benefits of lean office implementation are better use of the workspace, reduction of the bureaucracy, reduction of the rework, supply of real time information, improvement of the quality of products and services, engagement of workers and more motivated and skilled employees [26]; [14]; [21]; [23].

Thus, Sousa and Dinis-Carvalho [38] created a simple graphical tool of gamified training as a way to keep qualified the motivated employees, which optimizes the development of skills, such as teamwork, communication, leadership and even management of conflicts.

In order to reduce poor equipment reliability, delayed order delivery, and lost production, Fuchs [39], based on Lean Office philosophy and RCM methodologies, improve the implementation of maintenance management in the polymer injection molding process, obtaining increased availability of people and unplanned downtime of injection machines.



Nieuwenhuis [51] examined the impact of lean and “green” offices on subjective perceptions of air quality and workplace satisfaction, as well as objective measures of productivity, presenting a result that served to significantly increase the satisfaction in the workplace.

Another successful Lean Office project at a small local manufacturer was demonstrated by Chen and Cox [52], who propose a systematic procedure for conducting LO techniques to help everyone involved to understand its benefits and how to start it.

Sabur and Simatupang [53] verified, through the case study and the use of current VSM tools, future VSM, action plan, 5S and Standard work, whether the implementation of lean principles in a company's office environment can improve the response time to the customer and they proposed other solutions that are not in the basic Lean principles.

Magalhães [54] developed a KPI proposal and a dashboard that everyone could view and complete in order to obtain administrative process improvement based on Lean Office tools in an office environment of an academic department, what generated a 84% reduction in file search time, improvement in the development of forms for student registration and project management, as well as a 69% reduction in time searching for student information or data.

Freitas and Freitas [18] identify the main factors of information management in contexts of implementing lean offices, obtaining as a result that when using information and communication technologies (ICT) the use of paper decreases and the use of computers systems and electronic information flow increases.

In order to develop a detailed analysis of indicators for the lean implementation process in a shared services center (SSC), Sum [55], provides means to support the management decision-making process in relation to the steps taken in the lean implementation, presenting twelve indicators that reflect the current situation of the processes.

Table 7 was performed with the 15 main driving elements for LO application identified during the methodological flow in the material evaluation stage, when executing the content analysis of the most frequent categories present in the 28 most cited articles in the literature. This content analysis was carried out by the authors themselves based on their experience in researching the LO.

**Table 7: Main driving elements for applying the LO**

#	Elements:	The most cited articles (2011 – 2021)																												Freq
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
1	To integrate responsibilities and authorities of senior management and functional management to promote their involvement with the LO.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	73%
2	To identify and to work on the interrelationships between systems (technical aspects and human factors): favoring the relation of the organization with LO.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	70%
3	To define value from the customer's perspective and to identify the Value Stream to be improved.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	70%
4	To level knowledge and to provide training on key concepts of the Lean Office for a better understanding of the activities that the collaborators perform.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	90%
5	To represent visually the current workflow and the information of a process, identifying opportunities to avoid and/or to reduce the waste.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	80%
6	To identify Lean metrics and to monitor the performance to make visual display of cycle times, wait and delivery easier.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	80%
7	To represent visually future workflow, to distribute in a uniform way the volume/variety of work to reduce Lead Times.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	53%
8	To standardize terms, concepts, and processes to simplify the execution of activities, making them more objective and minimizing process errors.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	77%
9	To involve employees in the LO implementation process.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	77%
10	To promote the sharing of knowledge and individual experiences at the group level.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	70%
11	To encourage employees in the capacity for innovating and opportunities of improving in their workplaces.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	83%
12	To establish an effective flow of information to reach quickly in all the departments.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	67%
13	To create and to implement Kaizen plans (continuous improvement) in order to reduce conflicts between documents, processes and procedures.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	83%
14	To use organizational culture to support LO development.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	73%
15	To transfer knowledge and to promote communication and interaction with interested parties.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	77%

Source: elaborated by the authors.





The main challenges in LO implementation is related to technical difficulties, lack of training, cultural barriers, resistance to change, lack of knowledge about lean practices and financial constraints [23]. Lean training (driving element 4) is essential to establish a new mindset and culture that is essential for succeeding lean implementation, and then, it can be used as a base for all successful transformations [56].

Fryer [57] comment that employee qualification is a critical factor for succeeding continuous improvement (CI), and he is not the only author to state this [58]. CI (driving element 13) can be defined as a planned, organized and systematic process of incremental and continuous change [59]; [58]; [60]. The objective of CI for Garcia-Sabater et al. [59] is to obtain a cost reduction or an improvement in quality, flexibility or productivity. Both academics and professionals agree that to succeed in the CI initiatives, as it is a difficult process to implement, it requires deep changes and a high level of participation and commitment by employees [40].

An important aspect that must be considered when discussing the office is that the flow of information is usually the one that contributes the most to waste in administrative processes (driving element 5). A visual representation of the value stream can reveal hidden losses in the system and the problems associated with materials and information flows in a process [36].

All the time spent organizing areas will also be a waste if we can't keep everything in place and in the workflow. An obvious way to achieve this is to standardize documents and processes, such as filing, cleaning and storage, and, of course, keeping everything lean.

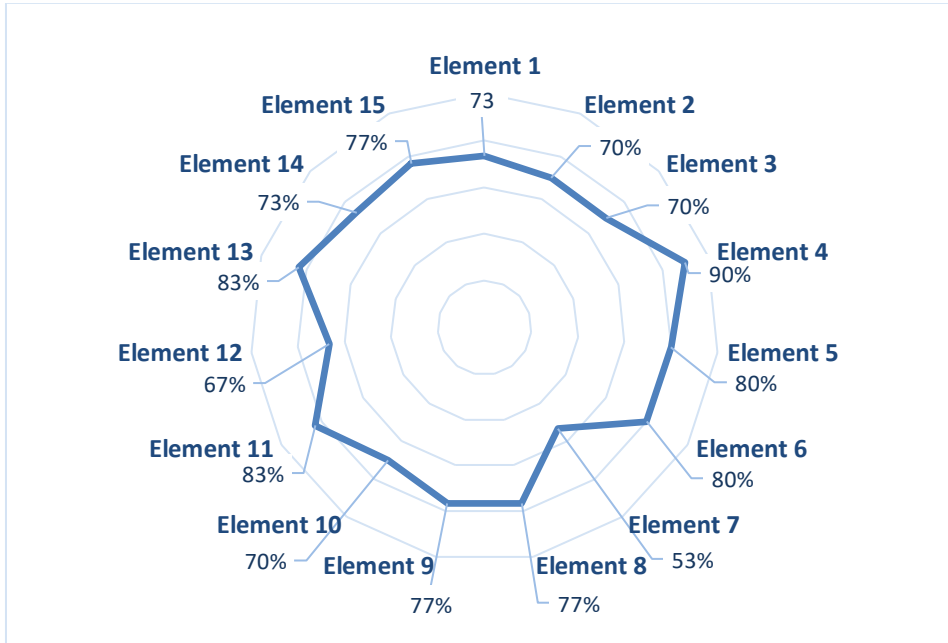
For example, it is possible to reduce the waste of resources by standardizing the LO (driving element 8), and, therefore, to minimize the impact that disposal would have on the environment.

For Monteiro [61], the main objective of standardization is to avoid wasting time looking for needed documents, data or supplies in a process, increasing efficiency and consequently improving the Lead Time of these processes.

Documentation standardization should simplify the execution of document activities of issuance, distribution, disposal, and control, making them more objective and minimizing process errors [61].

Next, a radar chart (Figure 7) was created, which consists of the 15 driving elements (Table 7) of the LO application. This chart presents an overview of the degree of importance related to these elements based on the frequency in which they were mentioned in the 28 most cited articles.

**Figure 7:** Degree of importance of the driving elements



Source: elaborated by the authors.

These elements approach various aspects of LO, such as training, document standardization, knowledge sharing, continuous improvement, process flow, etc. However, some of them are much more frequent than others in the articles analyzed. It is highlighted a possible Top 5 driving elements that had a frequency greater than or equal to 80% (4, 5, 6, 11 and 13), which are critical factors in the success of LO implementation in a company.

When adding another 5 driving elements with frequency greater than 70% and less than 80% (1, 8, 9, 14 and 15), Top 10 is reached with ten elements that are essentially important for a good development and maintenance of the LO in companies

## 5 Conclusions

The number of publications on techniques how to improve work processes in the office (LO) is low compared to the amount on improvements in production processes (Lean Manufacturing), however, the objective of the paper was achieved when founding in the literature on LO application, identifying the periodical that published the most about the subject, the most cited works, as well as the trends of its implementation. A sample of 28 articles was selected by the criteria adopted in the SLR protocol and by content



analysis, and through this sample, 15 driving elements were obtained for implementing and maintaining the LO in companies.

This study presents an academic contribution on LO implementation research from the point of view of reaching the state of the art, showing opportunities and trends through the driving elements found and analyzed.

For the application/management, the offered contribution occurs through the identification of the driving elements for implementing LO as well as the possible cuts considering the 5 most frequent or the 10 most frequent, depending on the degree of agility that is intended.

LO is an alternative to increase the productivity of companies and to make them even more competitive, in terms of cost, quality, deadlines and elimination of waste, based on their lean administrative processes. It requires teamwork, long-term commitment, worker/team involvement, management support and training. It can be a strategic opportunity for all companies to improve their administrative processes in a standardized way, following the path of the LO, using as guidelines the driving elements that result from this paper.

The limitation of the paper, at this moment, is the small number of studies of LO applications with scientific criteria, which increases the challenge and shows that there is still a lot of work to be done in order to develop a robust body of knowledge, and the work grows when considering the home office or the administrative repercussions of Industry 4.0 technologies.

In this sense, the suggestion for future work is to carry out studies of LO from other perspectives, increasing and expanding the analysis and discussion of this topic.

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