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REVIEW

Human factors involved in lean management: a systematic literature review

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This study analyses data from articles published from 2010 to 2019, which include empirical or theoretical-practical implications related to Human Resource Management (HRM) perspectives in a Lean environment. The main aim of this paper is to define Lean Management (LM) in light of HRM and identify HR themes. A Systematic Literature Review (SLR) of HRM in a Lean environment was carried out, based on the four well-known publishers, namely Emerald Online, Science Direct, Springer Link, and Taylor and Francis. In total, 180 relative papers published in 48 journals were collected. The affinity and the fishbone diagram were applied in order to group the practical implications of the studies into logical themes and sub-themes. Additionally, the Pareto diagram was used to prioritise the revealed themes. A high interest in soft-Lean practices has emerged in the last few decades. The practical implications of the reviewed articles have been grouped into eleven themes, revealing various aspects of HR involved in Lean management. Specifically, they concern Training, Leadership, Culture, Participation, HR department role, Commitment, Job Design, Teamwork, Communication, Impact on employee and Resistance to change.

Keywords: systematic literature review; human resource management; lean

1. Introduction

Lean production was born in the 1950s on the Japanese manufacturing shop floor, aiming at a systematic and continuous identification and elimination of wastes (overproduction, waiting, unnecessary transportation, inappropriate processing, unnecessary inventory, unnecessary motions and defects) to increase operations (Zhu & Lin, 2018) and business performance (Ghobadian et al., 2020; Nawanir et al., 2013). Lean can be approached as a set of management practices, tools and techniques such as Kanban method, equipment layout, Gemba, 6 S's approach, Just-in-Time, batch size reduction (Shetty et al., 2010) or as a long-term philosophy related to certain principles/elements (Singh et al., 2010). According to Green (1999, p. 23) Lean thinking 'comprises complex cocktail of ideas including continuous improvements, flattened organisation structures, teamwork, elimination of waste, efficient use of resources and cooperative supply chain management'. The concept of Lean has not yet been clearly defined, as there is no broad consensus about its roadmaps and frameworks, creating confusion among scholars (Bhamu & Sangwan, 2014; Ciano et al., 2019; Ghobadian et al., 2020) and difficulties in its long-term implementation among practitioners. The landscape is even foggy in terms of the

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so-called soft-lean practices (Bortolotti et al., 2015; Hernandez-Matias et al., 2019; Negrao et al., 2017), such as the human aspects of lean management, including managers' and employees' involvement commitment, training, or teamwork.

HRM-related factors may be the key to explaining why LM works in some companies and does not work in many others (Bonavia & Marin-Garcia, 2011). A large number of firms, motivated by lean growing recognition and its promising performance results, attempted unsuccessfully to pursue lean production or maintain results for a long time. In these cases, it was proved that the transition to an LM company is complex and faces many obstacles (Albliwi et al., 2014). The application of lean policies and practices entails organisational changes and employees' involvement (Furlan et al., 2011; Leon & Calvo-Amodio, 2017; Tortorella et al., 2018; Vidyadhar et al., 2016). The company transformation calls for the integration of employees' discretionary effort. It cannot occur without thorough human resources (Pakdil & Leonard, 2017; Yadav et al., 2019a). Bortolotti et al. (2015) pointed out that successful lean plants use soft LM practices more extensively than unsuccessful lean plants.

A significant number of worldwide empirical studies have been carried out in manufacturing and service industries, in private and public organisations, and in large or small and medium-sized enterprises (Agus & Hajinoor, 2012; Burawat, 2019; Grigg et al., 2020; Maarse & Janssen, 2012). These have occurred in different industrial sectors or various aspects of organisational operations but were mainly focused on hard-lean practices. The tools, methodologies, procedures, and techniques used to improve companies' processes by reducing waste were at the heart of scholars' interest (Larteb et al., 2015). However, successful LM implementation is not only the hard LM elements; it also must be supported by soft practices (Mamat et al., 2015). The combination of both soft and hard aspects of lean philosophy, as well as the alignment between them, is needed (Solaimani et al., 2019a). Shah and Ward (2007) defined LM as an integrated socio-technical system highlighting its social aspect apart from the technical one. The interest in the human factor elements has recently emerged; thus, very few studies still focus on HRM contribution for LM's successful implementation at the operational- or firm-level (Bonavia & Marin-Garcia, 2011; Martínez-Jurado et al., 2014). This results in a limited understanding of human factors involved in LM at a conceptual and technical level (Antony et al., 2020). Hence, Gaiardelli et al. (2019) stated that the debate about LM implantation and human factor elements is still open and this relationship requires further analysis. In the same line, Martínez-Jurado et al. (2014, p. 48) noticed that there are few studies that analyse the success factors of HR management in detail. Wickramasinghe and Wickramasinghe (2020, p. 1468) highlighted that 'it is very rare to find empirical studies on the transition of firms to advanced manufacturing systems and the adoption of HRM practices to facilitate such transitions'. Indeed, only a few empirical surveys examining the soft aspects or human elements associated with LM were found in the literature. For example, Hernandez-Matias et al. (2019) provided statistical evidence to support the relationship between management's (fostering a lean culture, providing support to lean) and employees' human-related lean practices (involvement and empowerment) with operational performance (waste reduction and flexibility). Wickramasinghe and Wickramasinghe (2020) also proved that a bundle of multifaceted HRM practices (work design, job-related training, talent management, supervision and knowledge sharing) contribute to the institutionalisation of lean production. Losonci et al. (2011) were focused on workers' perceptions and identified the critical intrinsic (commitment, belief) and external factors (lean work method, communication) that affect lean implementation success. Martínez-Jurado et al. (2014), using case study research in the aeronautics industry,

found that the setting up of joint management-trade unions and committees is a main factor in the pre-adoption phase, while training, communication, rewards, job design, and work organisation are the main factors in the following phases of LM adoption and implementation. Bonavia and Marin-Garcia (2011) supported the idea that the combination of lean production with HRM practices reduces inventory and boosts stock reduction and productivity.

On the other hand, many literature reviews, both systematic (Belhadi et al., 2018; Bortolini et al., 2018; Leon & Calvo-Amodio, 2017; Oliveira et al., 2019; Pagliosa et al., 2019; Pearce & Pons, 2019; Ruben et al., 2019; Sangwa & Sangwan, 2018; Solaimani et al., 2019a) or traditional (Hu et al., 2015; Jasti & Kodali, 2015; Moyano-Fuentes & Sacristan-Diaz, 2012; Negrao et al., 2017; Pinho & Mendes, 2017; Powell, 2013; Samuel et al., 2015; Stone, 2012), were conducted in an attempt to organise the existing knowledge in a robust way, shedding light to different areas of LM. However, a limited number address the ways in which HRM practices and LM are integrated to create the necessary conditions for successful implementation. Table 1 summarises the objectives of previous literature review studies concerning human factors involved in Lean research. It is apparent that most of them are out of date (before 2016) and there were only two surveys conducted up to 2018. Thus, a recent literature review in human factors of LM is required, given the growing interest of researchers during the last years, as well as the importance that it seems to play in lean successful implementation.

As already mentioned, a few empirical surveys and a limited number of literature reviews exclusively focused on the human factors involved in LM. However, there are some relevant references and various practical implications in the literature that described the appropriate HR policies and practices associated with LM, which is not easily accessible to policymakers and practitioners. This study located, retrieved, and read the literature about HR practices in LM. It intends to provide practitioners and academics with useful insights into the practical implications of human factors involved in LM, which

Table 1. Previous literature review studies concerning human factor involved in Lean.

Authors	Objectives The review focus on ...	Review period	Articles reviewed
Bhamu and Sangwan (2014)	factors related to human resource aid in implementing Lean philosophy	1988–2012	209
Hasle et al. (2012)	the effects of Lean on the working environment and employee health and well-being	1999–2009	11
Yadav et al. (2017)	organisational learning, innovation, and culture	up to 8/2015	105
Loh et al. (2019)	the Blue Ocean Leadership concept to address leadership issues	1990–2015	68
Dorval et al. (2019)	Lean culture in the manufacturing and service literature	up to 10/2016	678
Erthal and Marques (2018)	organisational culture dimension and their role to Lean implementation	1994–2016	65
Magnani et al. (2019)	the influence of the human dimension during the Lean adoption process	up to 9/2018	95
Costa et al. (2019)	human factor in fostering the establishment of Sustainable Continuous Improvement through LM	1990–2018	74

were spread out over a wide number of articles. In other words, the present review aims at answering the following research question:

RQ: What are the main themes of practical implications concerning human factor involved in Lean carried out worldwide the last 9 years?

The Systematic Literature Review (SLR) methodology was applied in the present study, as it is a replicable, scientific, and transparent process for the literature search and analysis (Hu et al., 2015; Sangwa & Sangwan, 2018). It minimises bias and errors and provides a reliable stock of knowledge and an audit path for the reviewers' decisions, procedures and conclusions (Tranfield et al., 2003). It has also been proven to be adequate for large, extensive reviews and their application proposed by previous researches in the LM field (Antony et al., 2020; Pearce & Pons, 2019).

The rest of the paper is divided as follows: in the next section, the Systematic Literature Review methodology is presented. In the next section, the results of the SLR are analytically presented and discussed. The paper concludes with a discussion of the practical implications. Finally, the limitations of the study and future research recommendations are presented.

2. Methodology

The present SLR study used the methodology proposed by Tranfield et al. (2003), which was also applied by recent studies on LM theory (Cocca et al., 2019; Erthal & Marques, 2018; Uriarte et al., 2020). This methodology consists of three stages: Planning, Conducting and Reporting.

2.1. Stage I – planning the review

At this stage, a panel of experts in the area of LM, composed of three practitioners (quality managers) and two academic experts, was formed. These practitioners were proposed by the authors – review team based on their expertise. Motivated by the justified rationale of the review as it was presented in the previous section, the members of the panel, at their first meeting, determined the review protocol. Specifically, they clarified the research questions and research boundaries, taking into consideration the research scope. They also decided on the search strategy for the collection of relevant studies. Thus, the period of time, the type of information, the databases for SLR search, the search strings, and the article type were argued.

The research was restricted to the articles that were published within a certain publication timeframe, between the years of 2010–2019. Eight articles which have published in 2020 were also included in the sample as they have been electronically published during the previous year. The main reason was that the number of academic articles related to LM increased substantially from 2010 onwards (Henao et al., 2019). Moreover, the present study focuses on human factors of LM, a field that has been mainly derived by researchers' attention in recent years (Magnani et al., 2019). Additionally, reviewing recent articles makes the SLR conclusions more updated and useful in practice.

Four internationally recognised databases – namely, Emerald Online, Science Direct, Springer Link, and Taylor & Francis – were selected. The search of articles was restricted to these electronic databases mainly due to incomplete access to other databases. The same approximate list of publishers has been included in similar SLR studies in LM (Antony et al., 2020; Loh et al., 2019; Sangwa & Sangwan, 2018). Only articles from the aforementioned data sources published in peer-reviewed international journals, which are

considered validated knowledge (Ordanini et al., 2008), were included in the research, following the same approach as previous researches in the field (Albliwi et al., 2014; Alkhor-aif et al., 2019; Erthal & Marques, 2018). Books, online sites, and grey literature were excluded similar to the studies (Antony et al., 2020; Psomas, 2018). In addition, to further increase the quality of the present SLR, only the journals included in the ABS (Association of Business Schools) 2018 list were considered (Antony et al., 2020). All article types, such as literature review papers, conceptual papers, or empirical ones (case studies and surveys) were included in the sample. These decisions formed the criteria for inclusion and exclusion of articles in the review (Table 2). These filters were adopted to limit selection bias on behalf of the reviewer team and to exclude the number of irrelevant articles while ensuring viable results.

To identify relevant articles, search strings were constructed based on the keywords and search terms. The search strings were a combination of search terms (usually two words in a certain order), which are entered by the review team into search engines to find desired results. The search strings were applied in the same way to bibliographic databases and each database was searched multiple times with different combinations of the search strings, resulting in a pool of multiple related articles. Examples of the used search strings are the following: ‘Lean’, OR ‘Lean manufacturing’, OR ‘Lean production’ AND (principles), (practices), (tools), (techniques) and (manufacturing companies).

The review team, which consisted of the paper’s authors, checked for any significant omissions or oversights resulting from the selection criteria. All the selected papers were extracted by indexed journals, which guarantees the quality of primary research (Hu et al., 2015).

Table 2. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Articles published between 2010–2019	Any publication before the year 2010 and after 2019
Articles presenting HR related practical implications	The other, not HR related, LM practical implications
Academic journals	Books, online sites and grey literature (conferences, master’s theses, doctoral dissertations, textbooks, reports, working papers from research groups, technical reports, etc.)
Well-known databases: Emerald Online, Science Direct, Springer Link and Taylor & Francis	Non-academic databases
Articles published in journals included in the ABS 2018 list	Articles published in journals not included in the ABS list
Fully accessed articles	Non-fully accessed articles
Articles studying Lean implementation issues (e.g. Lean principles, practices, tools/ techniques, performance, assessment, Leanness)	Articles studying an individual Lean principle, practice or tool/technique; articles studying Lean-Six Sigma, Lean-Agile and Lean-Green implementation issues
Articles related to the manufacturing sector	Articles related to the services sector, and construction industry
The unit of the analysis is the organization itself	The unit of the analysis is the supply chain network
Articles written in the English language	Articles written in other language

2.2. *Stage II – conducting the review*

At the second stage, the review team applied the search strings in the four selected databases. This initial search resulted in a large number of related articles. Then, the search results were screened and examined for their fit with the targeted study objectives, focusing on the title, abstract, and keywords. Taking into consideration the predefined inclusion and exclusion criteria, papers published before 2010 – like grey literature, books, online sites, non-English language papers or non-fully accessed papers – were manually removed. The members of the review team individually read the full text of the articles and excluded those which focused on individual LM principles/practices/tools/techniques or topics in remote research areas. Rejected articles were recorded by each reviewer. The list was checked by the review team in a meeting and there was consent to remove 34 articles. On the other hand, those which fulfil the eligibility criteria were selected for investigation and content assessment. The focus of the searches was limited to articles published in the LM literature and include an adequate level of detail on human management. This process resulted in a final sample of 187 articles. Further, seven duplicates were deleted and 180 articles remained for further in-depth analysis. Likewise, a previous SLR study focusing on practical implications and the future research agenda of lean manufacturing identified 401 papers (Antony et al., 2020). The papers were collected from the same management science publishers between 2010 and 2019. In the aforementioned study, the sample of articles was greater when comparing to the current research because of its broader research scope. However, in another survey, the identified studies (74) published between 1990 and 2018 were limited when the topic of focus was the role played by the human factor in fostering the establishment of a Sustainable Continuous Improvement through LM focus (Costa et al., 2019).

Following the proceedings of SLR (Hu et al., 2015; Tranfield et al., 2003), general information of the articles concerning the authors' surnames, the year of publication, the article title, the journal of publication, the publisher, the paper type, the data resource and the geographic research area were documented in an Excel spreadsheet. In addition, each member of the review team read the selected sample articles in full. Each reviewer identified, extracted and consequently stored relevant qualitative data concerning the research practical implications in a separate database (on an Excel spreadsheet). Each finding was randomly placed in an individual cell for further processing. Then, the review team systematised practical implications into specific categories, looking for similarities among the practical implications of the sample articles. To organise the mixed practical implications into clusters of meaningful themes, an affinity diagram was used (Moura Sa & Martins, 2016; Psomas, 2018). The statements were grouped into themes, based on their affinity or their inherent similarity. The decision for clustering the practical implications was based on the main component emphasised in each of them. The clusters were named using a single word or short phrase that reflects the content of the practical implications included. The descriptive nature of the data in this charting phase led to the identification of themes of practical implications. A meeting between the reviewer team was then held to form a consensus on identification. These reasonable themes provided a representative structure for a large amount of selected information and a clearer way of describing the literature. The same process was also followed by other researchers, who attempted to meaningfully organise the existing LM literature into main streams, enabling practitioners to identify knowledge and best practices more easily, and researchers to identify gaps in the extant literature (Alkhoraif et al., 2019; Buer et al., 2018; Yadav et al., 2017). The fishbone diagram was also drawn to visualise and further group the

practical implications of each theme. A fishbone diagram is a quality tool, given its name due to its resemblance to a fish's skeleton. It supports practitioners to discover the root cause of a problem. Furthermore, based on the number of the references supporting the study practical implications of each theme, a Pareto diagram was conducted using the statistical software Minitab, version 19. This was made in an effort to realise whether the Pareto principle 80/20 is confirmed, distinguishing the vital few themes from the useful many themes.

2.3. Stage III – reporting and dissemination

Based on the Excel spreadsheet developed in Stage II, general information of the sample articles was presented using charts and graphs, giving a clear picture of the LM involved in HR literature and revealing the trends of publications. An in-depth look at the practical implications of the LM studies was also provided in a systematic way. A full report (including an introduction, methodological protocol, commentary on the nature of the evidence identified, detailed findings, and conclusions) was written. Parts of this report are presented in this paper. Before the dissemination of the report, the experts' panel assessed its scientific quality and completeness.

3. Results

3.1. Descriptive analysis of the reviewed articles

In this section, some general characteristics of the included studies are presented. Firstly, the distribution of articles per publisher and journal was found. Specifically, the 180 reviewed articles were published in 48 journals and distributed by the four selected publishers (Table 3). The journals cited are from various scientific backgrounds and they are not limited to journals with quality and/or human research subjects. Out of these journals, most of them (39.6%) belong to Emerald, while almost half of the published articles (53.6%) are also included in the database of this publisher. Almost half of the journals (54.2%) published only one article of the sample. Taking into consideration the number of journals that have published articles with regard to the research focus, the Pareto principle of 80/20 is approximately reflected. This means that a 'vital few' journals (6 out of 19) have published most of the sample articles (55.3%), whereas the 'useful many' journals (13 out of 19) have published the remaining of the sample articles (44.7%). The *International Journal of Lean Six Sigma* seems to be at the top, with 23 articles, followed by *Journal of Manufacturing Technology Management* (20 articles), *Production Planning, and Control* (18 articles), *International Journal of Production Research* (16 articles), *International Journal of Operations and Production Management* (12 articles), and *International Journal of Productivity and Performance Management* (11 articles). The rest of the articles (80) were scattered in the other 13 journals. Thus, it is apparent that these six journals are the most influential journals in the field of LM. Thus, authors wishing to conduct future literature review studies in this field should base them firstly on these journals. It was found that 398 authors contributed to the sample articles. The high number of the authors who contributed to the publication of the sample articles confirms the increased academic interest in the field of Lean HR (Figure 1). Most articles were published under the co-authorship of three authors (31.1%), followed by those published under the co-authorship of two and four authors (27.2% and 21.7%, respectively). Co-authorship of more than five authors was not frequent (7.2%). The highest number of authors contributing to one article was six and was observed in the articles written by Costa et al. (2019) and

Table 3. List of journals considered in the study.

Publisher – Journals	Number of articles	Percent %
Emerald Online	97	53.6%
<i>International Journal of Lean Six Sigma</i>	23	12.7
<i>Journal of Manufacturing Technology Management</i>	20	11
<i>International Journal of Operations & Production Management</i>	12	6.5
<i>International Journal of Productivity and Performance Management</i>	11	6
<i>International Journal of Quality & Reliability Management</i>	5	2.7
<i>Benchmarking: An International Journal</i>	4	2.2
<i>Management Decision</i>	4	2.2
<i>The TQM Journal</i>	4	2.2
<i>Journal of Organizational Change Management</i>	2	1.1
<i>Industrial Management & Data Systems</i>	2	1.1
<i>Leadership & Organizational Development</i>	2	1.1
<i>Cross Cultural & Strategic Management</i>	1	0.6
<i>Employee Relations: The International Journal</i>	1	0.6
<i>International Journal of Organizational Analysis</i>	1	0.6
<i>Journal of Engineering, Design and Technology</i>	1	0.6
<i>Journal of Organizational Effectiveness: People and Performance</i>	1	0.6
<i>Management Research Review</i>	1	0.6
<i>Pacific Accounting Review</i>	1	0.6
<i>The Learning Organization</i>	1	0.6
Taylor & Francis	53	29.4%
<i>International Journal of Production Research</i>	16	8.8
<i>Production Planning & Control</i>	18	10
<i>Total Quality Management & Business Excellence</i>	8	4.4
<i>The International Journal of Human Resource Management</i>	3	1.5
<i>Research Technology Management</i>	2	1.1
<i>European Journal of Work and Organizational Psychology</i>	1	0.6
<i>International Journal of Computer Integrated Manufacturing</i>	1	0.6
<i>Knowledge Management Research & Practice</i>	1	0.6
<i>Production & Manufacturing Research</i>	1	0.6
<i>Quality Management Journal</i>	1	0.6
<i>Supply Chain Forum: An International Journal</i>	1	0.6
Elsevier	24	13.5%
<i>International Journal of Production Economics</i>	6	3.2
<i>Journal of Cleaner Production</i>	5	2.7
<i>European Management Journal</i>	2	1.1
<i>Journal of Operations Management</i>	2	1.1
<i>Journal of Business Research</i>	1	0.6
<i>Accounting, Organizations and Society</i>	1	0.6
<i>Computers & Industrial Engineering</i>	1	0.6
<i>European Journal of Operational Research</i>	1	0.6
<i>Journal of International Management</i>	1	0.6
<i>Journal of Manufacturing Systems</i>	1	0.6
<i>Operations Research Perspectives</i>	1	0.6
<i>Technological Forecasting & Social Change</i>	1	0.6
<i>Technovation</i>	1	0.6
Springer Link	6	3.5%
<i>Operations Management Research: Advancing Practice through Theory</i>	2	1.1
<i>Journal of Business Ethics</i>	1	0.6
<i>Journal of Industrial Engineering International</i>	1	0.6
<i>International Journal of Advanced Manufacturing Technology</i>	1	0.6
<i>Systemic Practice and Action Research</i>	1	0.6

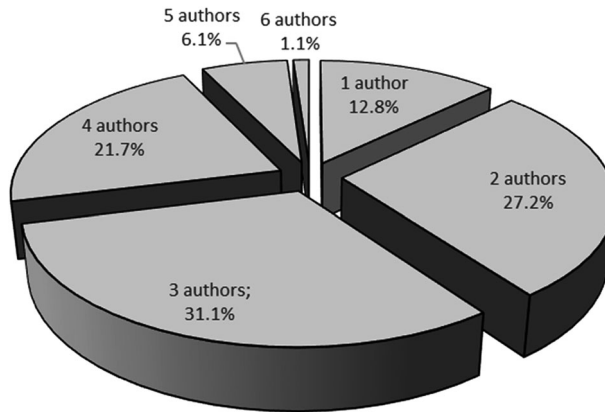


Figure 1. Authorships of the sample articles.

Yadav et al. (2020), which were a literature review and a case study, respectively. The author who has participated in the most researches or case study articles (9) in the field is Tortorella Guilherme, followed by Jain Rakesh, who has participated as a co-author in six articles (research or literature reviews).

Figure 2 shows the number of papers about LM with an HR focus during the latest ten years. The trend highlights the diachronic and gradual increase of Lean-HRM publication. From 2016, the trend shows a substantial increase, while in 2019, its growth was almost doubled compared to the previous year, indicating a peak in the interest of researchers. It is worth noting that more than half of the sample articles (55%) were published in the last three years of the review period, meaning 2018–2020. Not many publications have been identified during 2020, as publishing work may be in progress.

Research articles have the highest proportion (53.3%) of relevant publication, while the remaining articles present case studies (27.7%), literature reviews (14.5%), and conceptual studies (3.9%) (Figure 3). The article published by Bhasin (2012a) was accompanied by empirical research and case studies. It can be seen that most of the later articles (published in 2017–2019) used research (72%) as the method to study LM. This might be because of the former misunderstanding of the Lean Management concept, and the limited number of validated tools for its measurement. The 97 research studies used a variety of sample sizes, ranging from less than 10 to above than 1,000. In regard to the sample size of the reviewed articles, 49.5% of studies had less than 100 respondents as a sample, 22.6% had samples between 101 and 200, 11.8% of studies had a sample of more than 201 and less than 300, and 4.3% of studies had a sample between 301 and 400. Additionally, 2.1% of studies had a sample size between 401 and 500, 7.5% of studies had a sample size between 501 and 1,000, and only 2.2% of studies had greater than 1,001 as a sample size. All the research

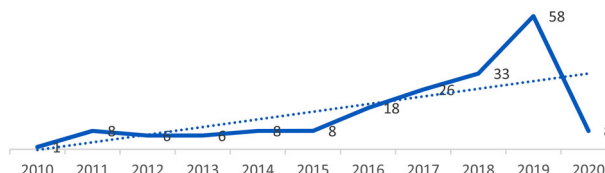


Figure 2. Articles per publication year.

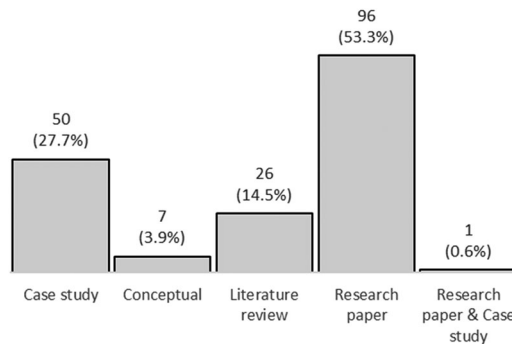


Figure 3. Article type.

papers focus on the manufacturing industry. Focusing on the 50 articles describing case studies, it is apparent that the majority of them (64%) were based on only one case organisation. The 18 remaining studies were multi-case studies, with 2 or 11 cases. For example, the article written by Hodge et al. (2011) was based on a convenience sample of 11 textile companies.

Table 4 classifies the 97 research papers, according to the geographical area of their origin, and indicates geographical areas more interested in LM with an HR focus. The studies described in the sample articles were conducted in more than 35 countries on 5 continents, highlighting a considerable geographical dispersion. More specifically, 31 studies were conducted in Europe, 24 in Asia, 19 in North and South America, 3 in Africa, and 2 in Oceania. Most of the empirical researches were conducted in Brazil (14), India (13), Italy (12), the USA (12), and The Netherlands (9). The UK is the country of origin of six studies, followed by Germany and Spain, with five relative articles. Eighteen articles contain samples from more than one country.

3.2. Themes of practical implications

Table 5 presents the themes of the 444 worldwide practical implications in the field of LM-HR. These practical implications, which are revealed from the 180 reviewed articles, were grouped into 11 themes through the affinity diagram. Each theme is supported by a number of references. It is apparent that the 11 themes revealed various aspects of HR involved in LM. Specifically, they concern Training, Leadership, Culture, Participation, HR department role, Commitment, Job Design, Teamwork, Communication, Impact on employee, and Resistance to change.

Table 4. Geographic research areas.

Geographical area	Number of studies	%
Europe	31	32%
Asia	24	24.7%
North and South America	19	19.6%
Africa	3	3.1%
Oceania	2	2.1%
Multinational	18	18.5%
Total	97	100%

Table 5. The themes of the LM-HR studies.

Theme	Supporting references
Training (88 findings)	Abolhassani et al. (2016)*; Bai et al. (2019); Bevilacqua et al. (2015); Bhasin (2011); Bhasin (2012a, 2012b); Bhasin (2012a); Bianchi et al. (2018); Boscari et al. (2016); Boyle et al. (2011); Burawat (2019); Burch and Smith (2019)*; Camuffo et al. (2017)*; Chaple et al. (2021)***; Chaplin et al. (2016); Chauhan and Chauhan (2019); Chauhan (2016); Chiarini and Brunetti (2019); Coetzee et al. (2019)*; Cullinane et al. (2017)*; Dave and Sohani (2019)*; De Sanctis et al. (2018); Demeter and Losonci (2019); Freitas et al. (2018); Ghezzi (2019); Grigg et al. (2020); Hodge et al. (2011); Hopp (2018); Jasti and Kodali (2016); Kobus et al. (2018)*; Kregel et al. (2019)*; Leon and Calvo-Amodio (2017); Lermen et al. (2018); Magnani et al. (2019); Majerus (2017)*; McAdam et al. (2016)*; Merwe (2017); Netland (2016); Panwar et al. (2015a); Pearce et al. (2018); Pinho and Mendes (2017); Rajagopalan and Solaimani (2019); Ringen and Holtskog (2013); Satolo et al. (2017); Seidel et al. (2017)**; Seidel et al. (2019); Sharma et al. (2016)*; Signoretti (2020); Sisson (2019)***; Soliman and Saurin (2017); Solaimani et al. (2019a); Tan et al. (2013); Thanki and Thakkar (2014); Thornton et al. (2019)*; Tortorella and Cauchick-Miguel (2018)***; Tortorella et al. (2018); Tortorella et al. (2020); Uhrin et al. (2017); Valente et al. (2019); Vidyadhar et al. (2016); Vinodh and Chintha (2011); Vlachos and Siachou (2018); Vlachos et al. (2020)*; Wickramasinghe and Wickramasinghe (2020); Zahraee (2016)
Leadership (71 findings)	Abreu-Ledon et al. (2018); Agus and Hajinoor (2012); Assen (2018a)**; Assen (2018b)**; Azyan et al. (2017)**; Bai et al. (2019)*; Belhadi et al., 2019; Bianchi et al. (2018); Burawat (2019); Camuffo and Gerli (2018)***; Chaple et al. (2021); Chiarini et al. (2018); Dave and Sohani (2019); Dun et al. (2017)*; Gelei et al. (2015)*; Grigg et al. (2020); Jadhav et al. (2014b); Knol et al. (2018); Knol et al. (2019); Loh et al. (2019); Mansoori et al. (2019)****; Martinez-Jurado and Moyano-Fuentes (2014)*; Nagaraj et al. (2019); Netland (2016); Netland et al. (2019)*; Nogueira et al. (2018)**; Poksinska and Swartling (2018); Rajagopalan and Solaimani (2019); Sahoo (2019); Seidel et al. (2019)*; Signoretti (2020); Solaimani et al. (2019b); Stalberg and Fundin (2018); Thanki and Thakkar (2014); Toledo et al. (2019); Tortorella and Fogliatto (2017)**; Tortorella et al. (2017a)****; Tortorella et al. (2018)*; Vidyadhar et al. (2016); Wickramasinghe and Wickramasinghe (2017); Yadav et al. (2019a)*; Yadav et al. (2020)
Culture (59 findings)	Abdallah et al. (2019); Angelis et al. (2011); Belhadi et al. (2017); Bevilacqua et al. (2017); Bhasin (2011); Bhasin (2012a); Bortolotti et al. (2015)*; Camuffo and Gerli (2018); Chaple et al. (2021)**; Coetzee et al. (2019)**; Dave and Sohani (2019); De Sanctis et al. (2018)****; Dorval et al. (2019); Dun et al. (2017); Erthal and Marques (2018)****; Frahm (2016); Gamage et al. (2017); Hwang and Shin (2019); Jadhav et al. (2014a); James (2019); Kull et al. (2014)*; Lagrosen and Lagrosen (2019); Losonci et al. (2017)**; Mathew and Taylor (2019); Mohammad and Oduoza (2020); Negrao et al. (2017); Pakdil and Leonard (2017)**; Paro and Gerolamo (2017); Rafique et al. (2016); Sahoo (2019)*; Solaimani et al. (2019b); Soliman et al. (2018); Thanki and Thakkar (2014); Tortorella and Fettermann (2018); Valente et al. (2019); Vlachos and Siachou (2018)*; Vlachos et al. (2020); Wickramasinghe and Wickramasinghe (2011)

(Continued)

Table 5. Continued.

Theme	Supporting references
Participation (42 findings)	Angelis and Fernandes (2012); Assen (2018a)*; Assen (2018b)*; Belhadi et al. (2017); Beraldin et al. (2019); Bevilacqua et al. (2017); Camuffo et al. (2017); Friela and Villechenon (2018); Fullerton et al. (2014); Furlan et al. (2011); Galeazzo and Furlan (2018)*; Galeazzo (2021); EL-Khalil (2018); Hasle et al. (2012); Hernandez-Matias et al. (2019)*; Hopp (2018); Jasti and Kodali (2016); Jing et al. (2017); Leon and Calvo-Amodio (2017); Losonci et al. (2011); Netland (2016); Panwar et al. (2015b); Pakdil and Leonard (2017)***; Rajagopalan and Solaimani (2019)*; Signoretti (2020); Taylor et al. (2013); Thanki and Thakkar (2014); Vidyadhar et al. (2016); Vlachos et al. (2020); Wickramasinghe and Wickramasinghe (2011); Wickramasinghe and Wickramasinghe (2017); Yadav et al. (2019a); Yadav et al. (2019b); Yadav et al. (2019c)
HR department role (33 findings)	Assen and Mast (2019); Birkie (2016); Camuffo and Gerli (2018); Camuffo et al. (2017)*; Coetzee et al. (2019); Dun et al. (2017); Furlan et al. (2011); Gaiardelli et al. (2019); Gonzalez et al. (2019); Hallavo et al. (2018); Hernandez-Matias et al. (2019); Jasti and Kodali (2019); Kregel et al. (2019)*; Kull et al. (2014); Longoni et al. (2013); Magnani et al. (2019)**; Menezes et al., 2010*; Netland (2016); Onofrei et al. (2019); Rodriguez et al. (2017)*; Sangwa and Sangwan (2018); Taylor et al. (2013); Uhrin et al. (2017)**; Wickramasinghe and Wickramasinghe (2020)*
Commitment (32 findings)	Abolhassani et al. (2016); Abu et al. (2019); Angelis et al. (2011); Bai et al. (2019); Belhadi et al. (2017); Beraldin et al. (2019); Bevilacqua et al. (2017); Boyle et al. (2011); Dave and Sohani (2019); Dibia et al. (2014); Frahm (2016); Hallavo et al. (2018); Hu et al. (2015); Jadhav et al. (2014a); Jasti and Kodali (2019); Khaba and Bhar (2018); Losonci et al. (2011); Martinez-Jurado and Moyano-Fuentes (2014)*; Netland (2016); Sahoo (2019); Salhieh and Abdallah (2019); Signoretti (2020); Sisson (2019); Uhrin et al. (2019); Ufua et al. (2018)**; Vidyadhar et al. (2016); Wickramasinghe and Wickramasinghe (2011); Yadav et al. (2019a); Yadav et al. (2019d)
Job Design (29 findings)	Assen (2018a); Beraldin et al. (2019)*; Bhasin (2012b); Botti et al. (2017); Chaplin et al. (2016); Cullinane et al. (2017)*; De Sanctis et al. (2018); Galeazzo (2021)*; Hasle et al. (2012); Hopp (2018); Losonci et al. (2011); Minh et al. (2019); Nagaraj et al. (2019)*; Neirotti (2020); Netland (2016); Pakdil and Leonard (2017); Rodriguez et al. (2017); Sancha et al. (2020)***; Signoretti (2020); Tortorella et al. (2017b); Tortorella et al. (2018); Tortorella et al. (2019a)
Teamwork (28 findings)	Angelis and Fernandes (2012); Bai et al. (2019)*; Bhasin (2012b); Boscari et al. (2016)**; Chapple et al. (2021); De Sanctis et al. (2018); Dominici and Palumbo (2013); Dun and Wilderom (2016)**; Manfredsson (2016); Mathew and Taylor (2019); Nagaraj et al. (2019); Netland (2016); Panizzolo et al. (2012); Poksinska and Swartling (2018); Ringen and Holtskog (2013)*; Rosin et al. (2020); Satolo et al. (2017); Sharma and Shah (2016); Tortorella et al. (2017a); Tortorella et al. (2019a); Wiengarten et al. (2015); Wong et al. (2014)

Communication (23 findings)	Alpenberg and Scarbrough (2016); Assen (2018a)*; Assen (2018b)*; Bevilacqua et al. (2017); Camuffo et al. (2017); Chaple et al. (2021)**; Costa et al. (2019); Dun et al. (2017)**; Frahm (2016); Fullerton et al. (2014); Losonci et al. (2011); Onofrei et al. (2019); Singh and Singh (2019); Tortorella and Fettermann (2018); Vidyadhar et al. (2016)*; Yadav et al. (2019a)
Impact on employee (22 findings)	Beraldin et al. (2019)***; Camuffo et al. (2017)**; Chaple et al. (2021); Ghobakhloo and Fathi (2019); Goshime et al. (2019); Hamja et al. (2019); Longoni et al. (2013); Minh et al. (2019); Mousavi et al. (2019)**; Neirotti (2020); Rodriguez et al. (2017); Soliman et al. (2018); Stimec and Grima (2019); Thornton et al. (2019); Manfredsson (2016)
Resistance to change (17 findings)	Abolhassani et al. (2016); Assen (2018b); Dora et al. (2016); Fullerton et al. (2013); Hallam et al. (2018)*; Jadhav et al. (2014a); Majerus (2017); Martinez-Jurado and Moyano-Fuentes (2014); McMackin and Flood (2019); Neirotti (2020)*; Piercy and Rich (2015)*; Sanctis, et al. (2018); Soliman et al. (2018); Taylor et al. (2013)

Note: *the paper includes two findings in the theme, **the paper includes three findings in the theme, etc.

The present SLR shows that the theme with the highest number of practical implications is Training (88 finding). The researchers highlight the importance of multi-skilled and flexible employees, and front-line leaders. The findings supported that organisations should emphasise development and on-the-job-training, as limited technical knowledge at the operational level is a significant barrier to LM implementation. The role of company leaders is also significant in the design of accelerator programs, the establishment and dissemination of a clear LM vision, and the implementation of a deliberate strategy. The theme of Leadership, which refers to the leaders' role during the LM process, is concentrated in 71 findings. The next revealed theme concerns the company and the national culture (59 findings). Culture seems to have a positive impact on LM implementation, constituting a supportive environment. The fourth theme, namely Participation, describes employees' sufficient involvement; without their assistance in the change, LM is not accessible (42 findings). Concerning the HR department, the 33 findings highlight the need to align its practices (such as recruiting, selection, performance evaluation, and training) with LM. The sixth theme, namely Commitment, focuses on the employees' and managers' engagement with LM (32 findings). Employee empowerment and motivation in the activities of LM implementation and managers' delegation give full support in the direction of improvement. The Job Design theme (29 findings) underlines that the introduction of new principles and methods in production changes the way that employees operate on the shop floor. Work standardisation and job classification help workers to reassign their job and improve their working conditions and ergonomics. The Teamwork theme refers to the setting up of work teams promoting LM concept and tools, supporting the production line, and providing the required consultancy to the workers (28 findings). It is also referring to the need for employees' cross-sectional collaboration to achieve this shared vision. The Communication theme (23 findings) reinforces the importance of the information and knowledge-sharing networks, which support the employees' mutual understanding of the benefits of LM, creating a positive perception. Clear communication is also necessary among operational units, as well as among all segments of the value stream. The next, in number of findings (22), theme refers to the positive or negative impact of LM to employees (specifically, regarding health, well-being, and job satisfaction). Finally, the Resistance to change theme (17 findings) refers to the workers' feelings of fear and insecurity, and the need to overcome their initial scepticism and resistance to LM.

Examples of practical implications grouped into themes are presented in [Table 6](#). The fishbone diagram, which is also called Ishikawa or cause-and-effect diagram, was drawn to visualise and group the practical implications of each theme. In this study, this technique was used to organise the practical implications of each theme to main groups. The reviewer team read carefully the practical implications of each theme and identified the main sub-themes. To take the analysis to a deeper level, information about the sub-themes has also been provided ([Figure 4](#)).

To further analyse and prioritise the revealed themes, a Pareto diagram was used, based on the number of study practical implications per theme ([Figure 5](#)). The Pareto diagram illustrates that four out of the eleven themes (36.4%) account for 58.6% of the practical implications in the field of LM-HR. The remaining seven themes (63.6%) account for 41.4% of the total findings. The Pareto principle of 80/20 seems to not apply, as neither 'vital few' themes nor 'useful many' themes can be identified. However, these four themes, namely Training, Leadership, Culture and Participation can be considered as 'vital', as they represent the majority of the practical implications (58.6%). Hence, the seven remaining themes can be considered as 'useful', as they are represented in the final sample of practical implications with almost 41.4%.

Table 6. Findings of recent empirical articles (2019–2020) grouping into 11 themes.

Training

Successful Lean managers need insight comprehension about Lean concept and implementation before persuading their employees to do with higher willingness and cooperation (Burawat, 2019); implementing LM in phases, phase II: enhancing labor flexibility with enhancement of related skills, and phase III: enhancing machine flexibility while consolidating the LM gains of the earlier phases (Chauhan & Chauhan, 2019); the factors for a successful Lean implementation are connected to the setting of long-term and medium-term Lean strategies, training people on Lean tools and principles, developing team building and effort, as well as putting in place a performance measurement system and measuring financial and economic results (Chiarini & Brunetti, 2019); in central India-based manufacturing industries there are a lot of hindering factors in the process of Lean implementation, but the most important one is the lack of understanding and knowledge; in central India-based manufacturing industries the effective Lean implementation can be done by having regular training (Dave & Sohani, 2019); startups are to carefully assess and select suppliers for Lean Startup Approaches courses and training sessions (Ghezzi, 2019); working with a company champion is only effective if the consultant engages closely with the champion, teaching him to become an effective Lean coach (Grigg et al., 2020); Lean education and training can benefit from the competencies relevant for Lean professionals; the different profiles among total quality managers, BPM professionals or Lean Sigma experts provide more specific trainings that better meet both the demand and the expectations of employers and employees equally (Kregel et al., 2019); training academies and collaborative working with experts from India and abroad is needed for LM implementation in India (Rajagopalan & Solaimani, 2019); the academics can contribute by including Lean as a part of the tertiary teaching curriculum; provide in-house training to both managers and employees at the firm level to enable them to have up to date knowledge of Lean and Lean performance dimensions (Thornton et al., 2019); companies that are more aware of LP implementation will better foster learning and knowledge sharing at all organisational levels by encouraging practices related to employees' involvement and problem-solving (Tortorella et al., 2020); employees should be open to advance their knowledge and expertise regarding Lean (Valente et al., 2019); training and workforce optimisation lead to the institutionalisation of Lean production (Wickramasinghe & Wickramasinghe, 2020)

Leadership

successful Lean production requires serious cooperation and attentions of all employees across company; thus, managers should create the good two-way relationship, sharing, caring, bottom-up communication and free-rein culture with their employees (Burawat, 2019); in central India-based manufacturing industries there are a lot of hindering factors in the process of Lean implementation, such as ineffective leadership (Dave & Sohani, 2019); the senior management is responsible for the five enabling factors in the Lean Iceberg model (technology, tools and techniques, process management, strategy and alignment, leadership, behavior and engagement) (Grigg et al., 2020); if the organisation has only developed Lean practices to a limited degree, managers should lead employees to take initiative by introducing improvement activities themselves (Knol et al., 2019); the role of coaches is significant in the design of accelerator programs based on the Lean startup methodology; coaches' experience is an important factor in entrepreneur-coach relationships because they are regarded as experts and their experience is considered as instruction for further action on the Lean startup methodology; coaches need to consider a process of consultation that is empowered by avoiding the pitfalls of exercising expert authority; coaches should be facilitators of knowledge accumulation and skill development than authority figures with extensive experience; coaches should limit their authoritative advice to suggestions and options and allow entrepreneurs to drive their processes (Mansoori et al., 2019); Lean leadership practices must be differentiated across different managerial levels to help alleviate the various barriers (Netland et al., 2019); LM leaders in the Indian industry need to engage strongly in increasing leadership training, leadership involvement in continuous improvements and gemba, in TPM, communicating strategy into the organisation by using methods like Balanced Score Cards and/or hoshin kanri methods

(Continued)

(Rajagopalan & Solaimani, 2019); a senior manager should be assigned as the policy's champion to make sure that all staff members are involved, quality circles and Lean circles are encouraged to assess processes and recommend improvements, all with a goal of promoting quality, efficiency, and productivity (Sahoo, 2019); the Lean coaching leadership, marked by goal-orientation and supportive attitude toward employees, appears to boost the backend processes and, even more, the front-end processes (Solaimani et al., 2019b)

Culture

Focus on innovation orientation, in terms of cultivating an organisational culture that promotes openness to new ideas and drives organisational efforts toward the objective of innovation, since it has beneficial impacts on both LM as well as innovation performance (Abdallah et al., 2019); in central India-based manufacturing industries the effective Lean implementation can be done only by creating a supportive environment, implementing awareness programs and developing a Lean-based culture to avail the full potential of LM, which ultimately leads to improved overall productivity (Dave & Sohani, 2019); organisational discourse in Indian workplaces has an impact upon work culture and workplace relationships and is particularly detrimental to specific elements of the 'human side' Lean philosophy, such as *kaizen*, *muda* and *andon* (Mathew & Taylor, 2019); put a focus on social-cultural changes while applying Lean technical tools; focus on cultivating an organisational culture that promotes openness to new ideas and drives organisational efforts toward the objective of Leanness since it has beneficial impacts on both business and operational performance (Sahoo, 2019); adopt a holistic view of Lean implementation, which avoids an exclusive focus on the technical perspective of Lean, thus encouraging a shift of culture toward learning, employee appreciation, collaboration, and investing in coaching leadership without which culture, collaboration, and practices cannot effectively be enabled (Solaimani et al., 2019b); leaders should invest all their efforts in trying to implement a Lean culture in their company, as not implementing it is likely to place their companies in disadvantage (Valente et al., 2019)

Teamwork

Team-based model is an integral part of Lean's success (Mathew & Taylor, 2019); the Lean implementation team can focus on both soft and hard Lean practices during Lean implementation (Nagaraj et al., 2019); companies undergoing a LP implementation that wish to particularly improve capabilities such as 'team learning and collaboration' should manage their teams to achieve a proper balance among members' characteristics (generations) (Tortorella et al., 2019a)

Participation

Managers and change agents should employ a dashboard of indicators to monitor employees' participation in *kaizen* activities or meetings and number of open and closed PDCA's over time, highlighting any unwillingness to participate or negative attitudes towards these initiatives (Beraldin et al., 2019); employees showing scarce involvement in Lean transformation results in delays of the returns of Lean investments (Galeazzo, 2021); employee involvement in Lean is achieved by increasing the level of employee's responsibility and involvement on continuous improvement activities, augmenting their skills and abilities and stimulating employees to provide ideas and possible solutions; employee empowerment in a Lean program is achieved by using employees well beyond the regular needs of production and helping them to develop multitasking abilities, providing them with more authority and autonomy regarding problem-solving and continuous improvement and by strengthening (Hernandez-Matias et al., 2019); by improving leadership involvement and enterprise enablers, further intensification of LM is possible; greater involvement of consultants, is needed for LM implementation in India (Rajagopalan & Solaimani, 2019); SMEs are advised to take up practices such employee involvement, for the successful implementation of Lean in their organisation (Yadav et al., 2019c); during the implementation of Lean, the role of parameters such as CI, JIT and AMP (active management participation), is crucial for an SME and should be implemented first (Yadav et al., 2019b)

Commitment

LM implementation requires time, money, energy and full company commitment (Abu et al., 2019); all Lean practices asking for an increased problem-solving may foster work engagement (Beraldin et al., 2019); the LPS framework includes top management commitment, -helpful to the professionals to identify various critical elements to be implemented, to understand the methodology of Lean production implementation procedures in any organisation and to frame the plan of

action to achieve excellence in manufacturing functions (Jasti & Kodali, 2019); managers are advised to make a commitment to sustaining a Lean and quality orientation throughout the firm (Sahoo, 2019); if Lean is going to be sustained, continuous efforts has to be exerted by Lean professionals to engage leaders and decision makers in the organisation and ensure proper values are nurtured; the external and internal environment (the environmental risk and the negative variation of past performance respectively) influences a company's commitment to increasing its level of Lean production implementation (Salhieh & Abdallah, 2019)

HR department role

A company making the transformation to Lean should develop visual performance management at an early stage, alongside other infrastructural practices such as HRM which makes the adoption of more targeted practices, such as JIT and TQM, easier (Assen & Mast, 2019); the direct relationship between the implementation of hard and soft Lean practices and physical work environment and job characteristics supports the building of a roadmap for LM implementation, taking into account the role of the human factors (Gaiardelli et al., 2019); human resource practices based on the Lean methodology have a positive impact on organisational performance (Gonzalez et al., 2019); a possible sequence in which a company should deploy human-related Lean practices continues with deploying the Employee-HRLP (Hernandez-Matias et al., 2019); the LPS framework which includes human resource management can be helpful to the professionals to identify various critical elements to be implemented, to understand the methodology of Lean production implementation procedures in any organisation and to frame the plan of action to achieve excellence in manufacturing functions (Jasti & Kodali, 2019); the respective candidate selection processes can benefit from the competencies relevant for Lean professionals; the competencies relevant for Lean professionals can be used for assessing and developing Lean management competencies on a corporate level (Kregel et al., 2019); the success of Lean production is largely influenced by the way in which HRM practices are designed, developed and implemented to deliver organisational excellence; the Lean duration creates a situation where a bundle of HRM practices is much more difficult to be imitated when compared with individual practices since imitation demands an understanding of the precise mechanisms by which each element interacts with another (Wickramasinghe & Wickramasinghe, 2020); operational intellectual capital and human, social and structural capital enhance the efficacy of investments in Lean practices (Onofrei et al., 2019)

Job design

Design stimulating jobs that satisfy both plant efficiency and productivity requirements and employees' need for engaging jobs that promote active learning; initially, workers usually have a greater diffidence in soft Lean practices, especially when they are not used to be involved in improvement projects and interface with managers, however, then, their positive perceptions of SLPs increase over time with a wider adoption and workers' experiences (Beraldin et al., 2019); radical organisational changes also affect employees' jobs and behaviours, thus forcing them to modify their habitual way of doing things such as Lean transformation; by continuously repeating the tasks underlying Lean practices, firms incrementally improve the way tasks are performed, meaning less resources and efforts are needed (Galeazzo, 2021); companies should consider the consequences of Lean initiatives on every single aspect of job characteristics if they aim at pursuing psychological strains (Minh et al., 2019); temporary work is essential to combine the forms of work effectively with existing high-performance manufacturing practices such as Lean; while the enhanced impact on mix and volume flexibility performance provided by temporary workers in the use of Lean practices may be an incentive for firms to adopt this form of work, they should consider both the long-term performance and social implications of precarious work; the use of temporary work practices increases the capability of Lean practices to enhance mix and volume flexibility performance objectives at the operations management level; rely on highly automated and well-defined processes and routines so that a constant change in the workforce does not reduce mix and volume flexibility performance benefits of Lean (Sancha et al., 2020); if LP practices are properly implemented, these can generate shifts in work habits and

(Continued)

the supposedly conflicting effects of individuals' working preferences (ruled by the corresponding generational values and beliefs) tend to be mitigated (Tortorella et al., 2019a);

Communication

Managers need to encourage informal conversations among employees in the plant as a form of sharing knowledge and organise events where people can openly discuss their Lean experiences (Onofrei et al., 2019)

Resistance to change

None empirical article in 2019 and 2020 supports this theme

Impact on employees

Managers should seek regular feedback on workers' satisfaction with participation in coaching sessions and problem-solving teams with a view to identifying any critical issues and preventing unsuccessful implementation of soft Lean practices; in the first implementation stages of LM, JIT, and in general the focus on muda reduction from processes, can undermine well-being through the health impairment mechanism which can prevail; applying and promoting soft Lean practices (SLPs) is not enough to guarantee employee well-being; rather, what matters is the extent to which workers perceive SLPs as useful and supportive, which depends both on the level of SLP adoption and on the individual worker's experience of coaching, participation in problem-solving and acknowledgement of their suggested improvements; in a Lean maturity phase, soft Lean practices become efficacious in offsetting the negative implications of Lean job demands (Beraldin et al., 2019); some of the LM practices had negative effects on job satisfaction (e.g. process and equipment), whereas others had positive effects (e.g. customer relationship, human resources and product design) (Minh et al., 2019); leading indicators (with regard to working environment, task characteristics, workforce characteristics, organisational factors) linked to Lean practices, can predict and monitor the effects of Lean implementation programs on employees' health and safety from the very beginning and prior to any adverse event; using occupational health and safety leading indicators (recordable injuries, worker's compensation cost, accident records, total lost working days) facilitates the engagement of safety professionals in Lean implementation processes and their relationship with Lean professionals; the occupational health and safety leading indicators can be prioritised according to the strength of Lean influence (Mousavi et al., 2019); LM should focus on the employees' safety and hierarchy and on regulating and balancing their stress (Stimec & Grima, 2019); organisations need to incorporate an employee satisfaction dimension into Lean (Thornton et al., 2019)

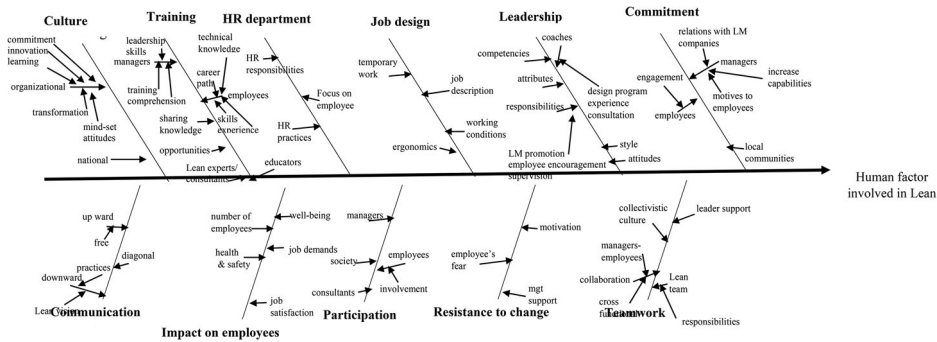


Figure 4. Fishbone diagram.

4. Discussion

Shah and Ward (2003) revealed 22 individual lean practices that combined into four bundles: Just in time, total productive maintenance, total quality management, and human resource management (HRM). This SLR focus on the last recognised category which is neglected by literature. Human factors are recognised in the LM literature as an essential part of LM, according to prior research (empirical or literature review). Recently, Sahoo (2019) supported that some of the soft Lean practices should be introduced into the LM journey early on to achieve higher organisational performance. However, they have not looked in depth at the role of HRM for the LM process to be executed successfully. Thus, there is an opportunity for research that fully analyses human involvement in LM implementation. A Systematic Literature Review (SLR) of HRM in

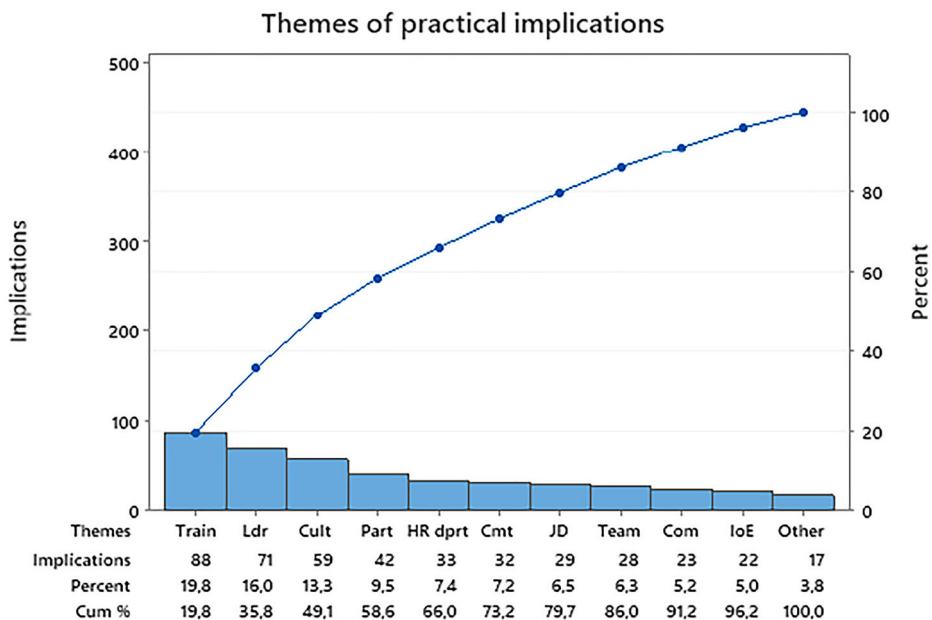


Figure 5. Pareto diagram.

LM was carried out using three acknowledged quality tools, namely Affinity, Ishikawa and Pareto diagram.

This SLR verifies the influence of Lean soft practices on performance, supporting previous findings in the field (Marodin & Saurin, 2013). It also reveals eleven main themes in the field of Lean-HR, namely Training, Leadership, Culture, Participation, HR department role, Commitment, Job Design, Teamwork, Communication, Impact on employee, and Resistance to change. The themes of Training, Leadership, Culture, and Participation are the top four of those included in the team of themes namely, ‘vital’, created based on the Pareto analysis, which distinguishes them from the ‘useful’ ones. The 444 practical implications of this SLR strive to understand the importance of soft Lean practices beyond the technicalities which wrongly dominate managers’ attention. Some of the revealed themes concentrate only on the top management team role (Leadership, Culture, HR department role), some only on the employees (Impact on employee, Resistance to change), but the majority of them on both managers and employees (Training, Participation, Commitment, Teamwork, Communication, Job Design). This fact may highlight the importance of the managers’ and employees’ involvement and collaboration in LM implementation. It is possible that companies that have an organised and staffed human resources department or human-centered leaders could better cope with the application of the soft Lean practices.

Most of the revealed themes are similar to the critical success factors of lean implementation, which have been revealed by previous researches (Table 6). For example, Yadav et al. (2019d) proposed six factors (management commitment & leadership, employee involvement, organisational culture, communication, training and skills, financial capability) that are comparable with the current ones, except for financial capability. Similarly, Azyan et al.’s (2017) success factors (practitioners’ understanding of lean philosophy, management leadership and commitment, upfront training in lean and effective communication) are close to the present SLR themes, apart from a hard-Lean factor (principles and methods). Olivella et al. (2008) also identified nearby success factors in lean production adoption, such as standardisation, ongoing training, teamwork, participation and empowerment, versatility, commitment to company values, and contingent rewards. In a similar vein, Wickramasinghe and Wickramasinghe (2020) found five relative HR-related important factors for the institutionalisation of lean production, namely, work design, knowledge sharing, job-related training, supervision and talent management.

5. Limitations and future research suggestions

The essential contribution of this research lies in presenting in an organised way the main insights proposed by HRM on Lean management. The revealed themes of practical implications can be used as a base for the development and validation of a soft-Lean practice measurement instrument and as a guide for LM implementation focusing mainly on the ‘vital’ themes. This paper explores the extensive value of Lean HRM and views it as a holistic approach based on the soft and hard aspects of Lean philosophy that lead to a never-ending search for improvement and greater efficiency. However, it suffers from some limitations. Firstly, the expert panel made the decision to focus only on academic ABS journal articles, while books, websites, conference proceedings, reports, and grey literature were excluded. Moreover, Scopus or Web of Science was not included. This can be considered a myopic practice. In addition, only English articles were used due to the authors’ linguistic limitations. This can also be considered a research limitation. Furthermore, the subjectivity of grouping the practical implications is also a limitation of this SLR. This

has shown some, but not all, of HRM practices, which may be associated with the implementation of LM. Thus, a replication of this review is encouraged to validate the structure of the revealed themes.

The findings of the present SLR are beneficial for researchers and practitioners. They can summarise human factors involved in LM, presenting them in an organised way. The revealed themes can be used by researchers as guidelines for their future studies. They could be a base for the development and validation of a soft-Lean practice measurement instrument. As far as practitioners are concerned, priority should be given to the ‘vital’ themes of practical implications and not the ‘useful’ ones. In other words, the ‘vital’ themes and the respective analytical practical implications should be adopted in order to properly adjust and improve their LM implementations.

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