Importance of first-line employees in lean implementation in SMEs: a systematic literature review

Viktorija Knapić
Department of Organization and Management, Faculty of Economics and Business, University of Rijeka, Rijeka, Croatia and School of Economics and Business, University of Ljubljana, Ljubljana, Slovenia, and

Borut Rusjan and Katerina Božič
Department of Management and Organization, School of Economics and Business, University of Ljubljana, Ljubljana, Slovenia

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Abstract

Purpose – Existing research evidence shows a fragmented understanding of the roles of first-line employees (FLEs) as essential factors for successful lean implementation in small- and medium-sized enterprises (SMEs), provoking recent calls for additional research on the identification of enablers and barriers for lean acceptance among workers. Therefore, this paper aims to identify related enablers and barriers to lean implementation among FLEs and determine future research avenues for improving the understanding of lean methodology implementation in SMEs.

Design/methodology/approach – Relying on a systematic literature review methodology, the authors aimed to synthesize and evaluate available peer-reviewed papers on the role of FLEs in lean implementation in SMEs. General descriptive and thematic analysis comprehensively depicted the selected research topic and identified the main themes within collected papers and potential future research questions.

Findings – The authors identified four main themes related to FLEs' role in lean implementation: cultural change factors, employee characteristics, management involvement and lean job design. Within each theme, the authors present a comprehensive overview of FLE-related factors and associated enablers and barriers that should be considered for a successful lean implementation in SMEs.

Practical implications – The research outcomes are important to practicing managers in SMEs, helping them facilitate lean acceptance and enhance the likelihood of successful lean implementation.

Originality/value – The insights from this study present building blocks in developing a lean implementation model for SMEs that considers the FLEs' role more comprehensively.

Keywords Enablers and barriers, First-line employees, Lean implementation, Small- and medium-sized enterprises

Paper type Literature review

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1. Introduction

Increasing market competition and environmental dynamism have forced businesses to focus on implementing efficient improvement programs to meet changing customer needs (Inuwa and Rahim, 2020; Prasanna and Vinodh, 2013). The lean methodology is increasingly being implemented to manage such challenges because it improves firm responsiveness to changing customer demands while simultaneously optimizing the underlying operating processes. The lean concept can be traced to the Japanese automotive manufacturer Toyota, which improved its processes to increase efficiency and eliminate waste, creating greater value for customers (Womack *et al.*, 1990; Womack and Jones, 1996). The main idea behind lean is the concept of continuous improvement of products and processes as well as elimination or reduction of activities that do not add value for the customer – so-called waste (overproduction, waiting, excessive inventory, motion, defects, unnecessary transport and over-processing) (Bhamu and Singh Sangwan, 2014; Gupta and Jain, 2013). Some of the common goals of lean implementation are a continuous flow of activities, reduced delivery times, improved quality at lower costs, waste elimination and minimized inventory (Hines *et al.*, 2004). Therefore, if properly managed, then lean allows firms to create a competitive advantage via cost reduction, enhanced productivity, high responsiveness to customer demand and improved quality (Hasle *et al.*, 2012; Womack, 2007).

Although the benefits of lean have been widely proclaimed and published, many firms struggle with lean implementation, especially small- and medium-sized enterprises (SMEs) characterized by scarce resources and complex processes (Dombrowski *et al.*, 2010; Goodyer *et al.*, 2011; Shah and Ward, 2003). Most of the research on lean implementation has focused on large firms (Belhadi *et al.*, 2019), limiting the transfer of the findings to SMEs because of their specific characteristics and needs (Dombrowski *et al.*, 2010; Rymaszewska, 2014). Lean implementation in SMEs is often considered a project involving introducing technical tools supported by external expertise (Achanga *et al.*, 2006; Kumar *et al.*, 2006). The predominant focus on the technical application of various tools with limited consideration of employees has provoked many lean failures (Huber and Brown, 1991; Womack, 2007). Fulfilling the guiding principles of lean requires continuous learning and dynamic adaptation of employee operations (Dombrowski *et al.*, 2012; Gambatese *et al.*, 2017; Hasle *et al.*, 2012).

The shift from control-focused work systems toward lean has had a considerable effect on first-line employees (FLEs) (alternatively, shop-floor or "blue-collar" workers) (Boxall and Macky, 2007; Godard, 2004). By "first-line employees," we mean employees directly involved in producing products or providing services (Lande *et al.*, 2016; Shokri *et al.*, 2016; Womack and Jones, 2003). They work in a context different from that of managers at higher levels (e.g. different work environments, motivation systems and responsibilities) (Huber and Brown, 1991), and they are expected to be excited about and committed to adopting lean (Womack *et al.*, 1990).

Existing literature reviews have contributed significantly to the understanding of the barriers and enablers of lean methodology in SMEs (Hasle *et al.*, 2012; Hu *et al.*, 2015; Khazanchi *et al.*, 2007; Magnani *et al.*, 2019; Sony and Mekoth, 2019) but have failed to consider comprehensively the lowest hierarchical level, which was previously found crucial (Vidal, 2007). Hence, authors in the field of lean have emphasized the need for a better understanding of FLEs' behavioral aspects, alongside the various contextual determinants (Schmidt, 2011; Zhang *et al.*, 2012), especially in the SME context (Campagna *et al.*, 2020; Hu *et al.*, 2015; Losonci *et al.*, 2017; Pearce *et al.*, 2018) in which companies are significantly lagging in lean implementation, besides the great potential (Pech and Vaněček, 2018). However, the existing literature offers anecdotal evidence from studies focusing on employees in SMEs and their role in lean implementation (Hines *et al.*, 2011; Losonci *et al.*,

2017, 2011; Shokri *et al.*, 2016), with the main focus on the identification of critical success factors, readiness to embark on lean applications of human resource practices and measuring employees' performance. Moreover, some studies have partially explored mechanisms for fostering FLEs' motivation, engagement and involvement in lean initiatives (Boxall and Macky, 2007; Cullinane *et al.*, 2017), leaving the topic underexplored, vague and unsystematized. This study answers the existing calls for further clarification of the employees' role in the specific contextual conditions of SMEs to achieve successful lean implementation (Bortolotti *et al.*, 2015; Magnani *et al.*, 2019; Thirkell and Ashman, 2014). Hence, we aim to:

- identify the main themes and factors related to FLEs' role in lean implementation in SMEs; and
- determine associated enablers and barriers that can help practicing managers in SMEs facilitate lean acceptance and enhance the likelihood of successful lean implementation.

To correctly outline the structure of this field, we intend to extract themes – representing groups constructed based on shared meaning topics related to the role of FLEs in SME lean implementation. We further divide the themes into factors – representing elements of themes that positively or negatively impact the FLE role in SME lean implementation. In this analysis, factors act as content subsections of themes. Enablers represent characteristics of identified factors that promote and help FLEs in successfully engaging in SME lean implementation, and barriers represent characteristics of factors that act as obstacles or issues which prohibit adequate involvement of FLEs in successful SME lean implementation. Therefore, the study will address the following research questions (RQs):

RQ1. What has been studied regarding first-line employees and their roles in lean implementation in small- and medium-sized enterprises?

RQ2. What are the main themes, factors and related enablers and barriers of lean implementation in small- and medium-sized enterprises that emerge concerning the role of first-line employees in lean implementation in small- and medium-sized enterprises?

The paper is organized as follows: first, we provide a theoretical baseline regarding the specifics of lean methodology implementation in SMEs and the importance of FLEs in lean implementation, introducing the focus of our research on the role of FLEs in lean implementation in SMEs. We then explain the methodology used for our literature review and follow up with a discussion of the findings. Finally, we identify and discuss limitations and potential future research.

2. Literature review

2.1 Lean in small- and medium-sized enterprises

SMEs have distinctive characteristics that significantly influence the success of lean implementation (Achanga *et al.*, 2006; Shah *et al.*, 2008). Existing literature shows that the main objective for lean implementation in SMEs is optimizing operation processes and waste reduction (inventory, space and lead and delivery time) (Dora *et al.*, 2014; Grewal, 2008; Hu *et al.*, 2015). Not surprisingly, the lean tools implemented most often in SMEs are value-stream mapping, Kanban, 5S/6S and visual management (Alkhoraif *et al.*, 2019; Hu *et al.*, 2015).

Although lean is a highly convenient program for implementation in SMEs (Hu *et al.*, 2015), the literature contains much evidence of implementation failures, with failure rates of 60–90% (Secchi and Camuffo, 2019). The required implementation cost and the uncertainty of the subsequent benefits, alongside the high failure rate, limit the commitment and application of lean in SMEs (Achanga *et al.*, 2006; Ping-yu, 2009) compared to large enterprises (Shah and Ward, 2003). Therefore, many comprehensive studies of lean implementation in SMEs have aimed to understand critical barriers that prevent and critical success factors that enable successful lean implementation in SMEs (Hu *et al.*, 2015; Rymaszewska, 2014; Yadav *et al.*, 2019b).

Leadership and management strategy, organizational culture, education and training and employee involvement were most often listed as critical success factors for successful lean implementation in SMEs (Achanga *et al.*, 2006; Bhamu and Singh Sangwan, 2014; Timans *et al.*, 2012). Hence, some specifics of SMEs act as enablers and barriers to lean implementation. For instance, lack of funding (Panizzolo *et al.*, 2012), underdeveloped processes and quality control systems, lower supply-chain power for just-in-time delivery, poor management supervisory and support (Alkhoraif *et al.*, 2019) and greater demand variability (Dowlatshahi and Taham, 2009) act as barriers. Difficulties in acquiring and retaining lean managers who will guide the implementation of sophisticated lean principles with the underpinning human resource management practices is a severe limitation for SMEs (Tortorella *et al.*, 2015). On the other hand, production system flexibility, good communication, long-term commitment to maintaining the business, greater government support and multiskilled employees (Hu *et al.*, 2015; Rymaszewska, 2014) serve as enablers for lean implementation in SMEs.

Full lean implementation usually requires substantial investments; thus, a fruitful environment for lean implementation requires economic stability (Costa *et al.*, 2019; Mazanai, 2012). The requirements for upfront projection of implementation costs and related benefits (Achanga *et al.*, 2006), the uncertainty of financial benefits and the time lag between the implementation and the financial benefits make lean implementation in SMEs less viable (Zhou, 2016). Therefore, SMEs could consider less sophisticated and inexpensive lean tools, such as 5S, kaizen, value-stream mapping, standardization and total productive maintenance for internal improvement as steppingstones to lean implementation (Chaplin *et al.*, 2016; Hu *et al.*, 2015; Lee, 2004; Nguyen, 2015). Other more sophisticated lean tools (e.g. level scheduling and small-lot sizing) should be implemented subsequently (and partially according to a firm's specific operating conditions) after the creation of initial internal capacity (Done *et al.*, 2011; Hu *et al.*, 2015; Mathur *et al.*, 2012; Rose *et al.*, 2013). Fewer organizational layers in SMEs facilitate flexibility and promote change, lower bureaucracy and direct communication between managers and employees, acting as a strong enabling factor (Dowlatshahi and Taham, 2009; Huber and Brown, 1991). However, the informality could jeopardize the adoption of lean practices that rely on process standardization (Timans *et al.*, 2012).

2.2 Lean and first-line employees

The literature has not reached a consensus about the implications for employees involved in the lean implementation in SMEs (Hasle *et al.*, 2012; Hu *et al.*, 2015; Losonci *et al.*, 2011; Pearce *et al.*, 2018; Shokri *et al.*, 2016). Lean demands a high degree of responsibility for employees' work (Panizzolo *et al.*, 2012) as well as flexible, multiskilled employees who can successfully work in teams, continuously improve processes and actively solve problems (Andersson *et al.*, 2006), allowing employees to work "smarter" instead of "harder" (Womack, 2007). However, some authors (Boyle and Scherrer-Rathje, 2009; Conti *et al.*, 2006; Lewchuk and Robertson,

1996) argued that the inherent characteristics of lean could hinder rather than facilitate employee productivity. Work intensification, increased responsibility and accountability, higher peer pressure and continuous involvement in the production process may create unfavorable working conditions (Delbridge *et al.*, 1992) and counteract job autonomy, decision-making involvement, upskilling and active participation in problem-solving activities (Parker and Slaughter, 1988; Parker, 2003). Delbridge (2005) and Conti and Gill (1998) posited that the potential adverse effects of lean on employees are contingent upon the design and operation of lean production systems. Hence, authors have suggested establishing smart human-resource management systems that allow the coexistence of high-involvement work and intensive lean practices (Kramar, 2014; Neirotti, 2020).

Shokri *et al.* (2016) and Alhuraish *et al.* (2017) emphasized that "softer" variables of employees' behavior and cultural changes can be essential for lean implementation and require further exploration. Careful lean employee selection and proper rewards increase employees' involvement and engagement in lean implementation (Hu *et al.*, 2015; Singh and Rathi, 2021). On the other hand, a lack of empowerment and benefits decreases engagement and participation, leading to lean implementation failure (Antomarioni *et al.*, 2020). Surprisingly, evidence is rare concerning the importance of FLEs' behavioral attitudes in lean applications (Hines *et al.*, 2011; Losonci *et al.*, 2011; Ramadas and Satish, 2018a, 2018b). One possible reason might be the extensive focus on operational and financial performance measurement instead of employees' behavioral changes. A holistic lean implementation requires developing a supportive cultural environment, which is usually time- and resource-intensive (Hines *et al.*, 2011).

Successful lean adoption requires careful planning for the pre-implementation, implementation and post-implementation phases. For the pre-implementation phase, lean awareness programs should be created to overcome initial resistance, increase trust in lean benefits and create a long-term commitment to a quality culture, especially among FLEs and their supervisors (Bhamu and Singh Sangwan, 2014; Liker and Wu, 2000). Hence, external training and education programs based on lean principles might create the needed employee readiness and empowerment for the implementation phase (Gunasekaran and Lyu, 1997). The post-implementation phase should assure continuous improvements after the implementation phase. Therefore, lean adoption requires consideration of various technical, organizational and social changes (Åhlström and Karlsson, 1996). Managerial views on lean as a prominent tool for process improvement while neglecting human aspects for sustained change and continuous improvement often result in absolute implementation failure in SMEs (AlManei *et al.*, 2017; Panizzolo *et al.*, 2012; Pearce *et al.*, 2018).

3. Methodology

We have performed a systematic literature review (SLR) to fully consider, evaluate and synthesize existing research efforts (Cooper, 2015). Many authors have confirmed the importance of SLRs to identify underexplored questions in specific areas to provide better understanding (Cronin, 2011; Jesson *et al.*, 2011). Therefore, we followed Thomé *et al.*'s (2016) step-by-step research approach (Figure 1), which builds on established SLR methodologies, such as the ones suggested by Cooper *et al.* (2009) and Denyer and Tranfield (2009). The step-by-step SLR research methodology consists of eight steps:

(1) planning and formulating the problem;

(2) searching the literature;

(3) data gathering;

(4) quality evaluation;

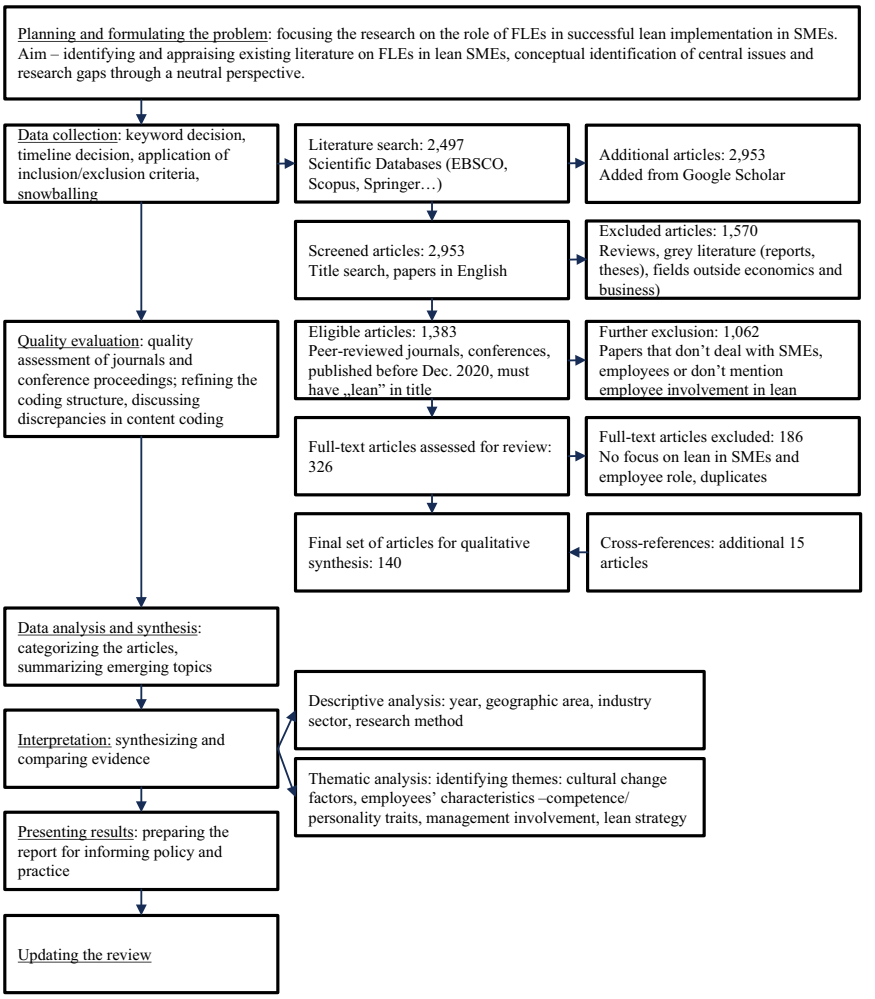

Figure 1.
Research approach and process

(5) data analysis and synthesis;
(6) interpretation;
(7) presenting results; and
(8) updating the review.

After defining the research's broad area and related research questions, we searched the Web of Science, Springer Link, Science Direct, Scopus–Elsevier and Taylor and Francis databases, which cover most of the top publications in the field of management, avoiding a restrictive review of available literature. Therefore, as a quality proxy, we included only international scholarly peer-reviewed literature published up to December 2020. Hence, we also included conference papers published in high-quality

conference proceedings because they usually cover a large body of up-to-date knowledge (Bandara *et al.*, 2015). Of 140 papers, 23 stem from conferences. To assure they are peer-reviewed, we manually checked each conference. Gray literature and working papers were excluded for the sake of rigor. Using brainstorming and snowballing, we selected the following search keywords/strings: "SME/small business," "lean" and "employee/worker" (Table 1). Considering the specific topic of interest (Jesson *et al.*, 2011) and the relevant criteria for inclusion (Figure 1), the initial search on the topic resulted in 2,497 papers of interest. We also searched Google Scholar to retrieve potentially relevant articles not included in the research databases, which expanded the total selection to 2,953 papers. In the next stage, we omitted literature unrelated to our areas of interest (e.g. Tanco, Santos, Rodriguez and Reich, 2013), reducing the number of papers to 321. We additionally included 15 relevant using cross-references in the final list of articles. After reading the full-text papers and omitting duplicates, the number was reduced to 135 final papers.

Finally, we approached a careful analysis and synthesis of the articles. Following Tranfield *et al.* (2003), we covered general descriptive analysis and thematic analysis to depict the selected research topic comprehensively. The descriptive analysis allowed a simple categorization of the selection of literature, the key journals and trends of publishing, region and industry sectors and research methods. On the other hand, the thematic analysis

Database	Keywords/search string
Web of Science	(TS=(lean AND SME* AND employee*)) AND LANGUAGE: (English)
	(TI=(lean AND SME*) AND AB=(employee*)) AND LANGUAGE: (English)
	(ALL=(lean AND SME* AND employee*)) AND LANGUAGE: (English)
	(ALL=(lean AND small business AND employee*)) AND LANGUAGE: (English)
	(TS=lean AND ALL=(SME* AND worker*)) AND LANGUAGE: (English)
SpringerLink	lean AND SME AND employee
	lean AND SME AND worker
	lean (titled) AND small AND business AND worker
	lean (titled) AND small AND business AND employee
Science Direct	lean AND SME AND employee
	lean AND SME AND worker
	lean AND small business AND worker
	lean AND small business AND employee
Scopus–Elsevier	TITLE-ABS-KEY (lean AND sme* AND employee*)
	TITLE-ABS-KEY(lean AND SME* and worker*)
	(TITLE(lean) AND TITLE-ABS-KEY(small AND business AND employee)) AND DOCTYPE(ar OR cp)
	(TITLE(lean) AND TITLE-ABS-KEY(small AND business AND worker)) AND DOCTYPE(ar OR cp)
Taylor and Francis	[All: lean] AND [All: sme*] AND [All: employee*] AND [Publication Title: lean]
	[All: lean] AND [All: sme*] AND [All: worker*] AND [Publication Title: lean]
	[Publication Title: lean] AND [All: small business] AND [All: worker]
	[Publication Title: lean] AND [All: small business] AND [All: employee]
Google Scholar	allintitle: lean employee OR SME
	allintitle: lean worker OR SME

Notes: TS = topic, TI = title, ALL = all fields, Booleans (AND). Boolean "AND" signifies all words in the search must be included in all results, "OR" if only one word of the search is included in the results. TITLE-ABS-KEY signifies the search was limited to the papers' title, abstract and keywords. DOCTYPE signifies the document type (we included conference papers and scientific articles)

Table 1.
Databases and search strings for the literature review

enabled the identification of the main themes in the collected papers and potential future research questions. Through parallel and simultaneous coding and categorizing supported by the QDA Miner program, we refined the coding structure to summarize and understand the main emerging topics and discuss potential discrepancies in content coding until we reached a consensus. The calculated interrater reliability was high (0.93), showing sufficient coding consistency and agreement among the coders (Miles and Huberman, 1994). The results of descriptive and thematic analyses are discussed in the following sections.

4. Descriptive analysis

The descriptive analysis shows the continuous increase in publications addressing employees' roles in lean initiatives in SMEs (Figure 2). The first published paper included in this analysis dates back to 1995 (O'Donnell, 1995). The number of research papers on the topic has grown exponentially, peaking in 2019. Figure 2 depicts the research trends addressing employees regarding lean applications in SMEs. The amount of research has grown steadily, gaining more traction since 2010, after which it showed continuous growth.

From the entire sample, 114 papers indicated the addressed geographic area (approximately 81% of the papers). The most significant emphasis has been on European firms (34%), followed by Asian ones (28%), whereas South America and Australia received the least attention (Figure 3). Further analysis of European and Asian studies found a majority had focused on lean implementation in the UK and India. Some studies focused on

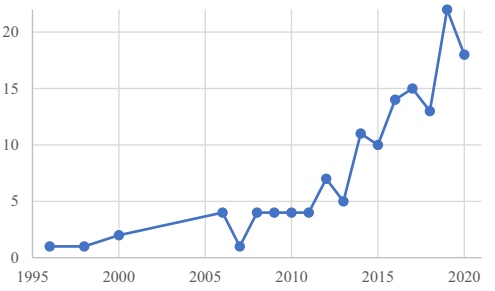

Figure 2.
Number of papers published per year

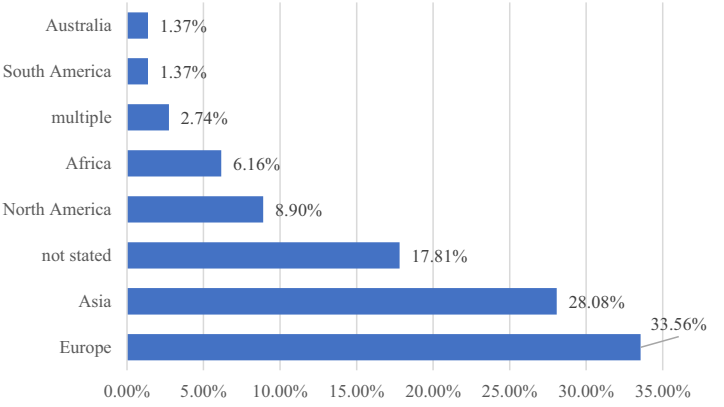

Figure 3.
Researched geographical area in lean small- and medium-sized enterprises articles dealing with employee roles

one specific industry (together, they represent 68% of all the papers in this analysis), while others (21%) considered multiple industries or presented cross-industry analyses including several different industries (Nguyen, 2015; Robinson and Schroeder, 2009; Stanica and Peydro, 2016). Overall, the manufacturing sector was predominantly addressed (Figure 4, 57% of the papers, cf. Antomarioni *et al.*, 2020; Nikolou-Walker and Lavery, 2009; Tan *et al.*, 2013; Timans *et al.*, 2016). Some literature reviews or conceptual papers did not address specific industries but focused on researching lean in SMEs as a methodology in general (Lauver *et al.*, 2018; Salma *et al.*, 2018; de Treville and Antonakis, 2006). These papers were marked as "industry not stated" in Figure 4. Some industries were mentioned only in one paper, so we combined those into one segment – "other." These include the food industry, steel and oil industry and meat processing.

Of 140 articles reviewed, 38% used questionnaires for their empirical research (Lauver *et al.*, 2018; Marin-Garcia and Bonavia, 2015; Santos *et al.*, 2015; Wickramasinghe and Wickramasinghe, 2016; Wong *et al.*, 2009). Around 37% of papers are case studies (Majava and Ojanperä, 2017; Orji-Oko *et al.*, 2015; Yuik and Puvanasvaran, 2020) and around 7% used various mixed methods [combination of questionnaires and interviews (Antosz and Stadnicka, 2017; Seppälä and Klemola, 2004) or observation and interviews (Lewchuk and Robertson, 1996; Stanica and Peydro, 2016)]. A smaller number of articles presented literature reviews or theoretically examined workers' roles in lean SMEs (Cullinane *et al.*, 2013; Dombrowski *et al.*, 2012; de Treville and Antonakis, 2006).

5. Review findings

Four main themes emerged from the literature analysis on FLEs' role in lean implementation in SMEs: cultural change factors, employees' characteristics (competence/personal traits), management involvement and lean job design. In the following sections, we present the discussion of the main themes, their underlying factors and the related literature. Based on underlying factors, enablers and barriers are identified within each of the main themes, and they are presented and summarized at the end of each theme description (Tables 2–5).

5.1 Theme 1: cultural change factors

As a sociotechnical system, implementing lean requires a cultural change to make the lean journey feasible (Womack, 2007). Thus, understanding the organization's underlying cultural values, assumptions and beliefs can notably support lean's effectiveness (Al-Najem

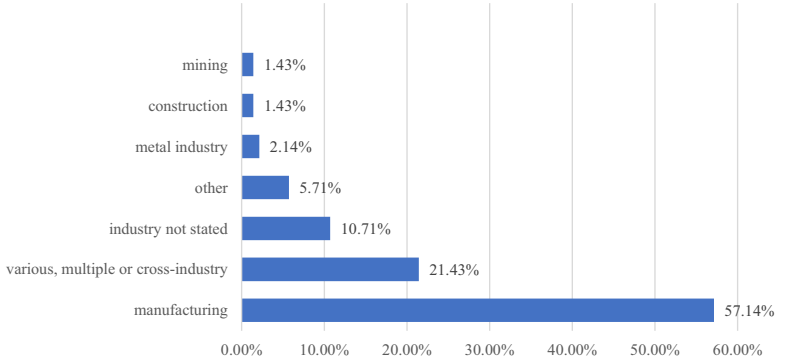

Figure 4.
Researched industry in lean small- and medium-sized enterprise articles dealing with employee roles

Table 2.
Enablers and barriers of the cultural change factors for first-line employees in lean implementation in small- and medium-sized enterprises

Role	Cultural change factors
Enablers	Training, practicing and mentoring (Alefari *et al.*, 2017)
	Creativity allows high autonomy (de Haan *et al.*, 2012)
	Leadership, teamwork, innovation and organizational culture (Burawat, 2019; Li *et al.*, 2015)
	Commitment, communication, work methods and beliefs (Losonci *et al.*, 2011)
	Employees design lean policies and programs and influence everyday decisions (Marin-Garcia and Bonavia, 2015)
	Cultural dimensions in high person-centered culture (Cadden *et al.*, 2020; Kull *et al.*, 2014) encompass work environment, communication and trust (Dora *et al.*, 2016)
	Enhancing employee awareness of lean benefits (Eswaramoorthi *et al.*, 2011)
	Countries with low performance and future orientation, lower assertiveness and high uncertainty avoidance (Kull *et al.*, 2014)
Barriers	Lack of understanding of lean benefits, job-related strain and job ambiguity (Bergquist and Westerberg, 2014)
	Perceiving lean as additional work (Burawat, 2019)
	Excessive participation (Brännmark and Holden, 2013)
	Lack of awareness of health and safety procedures – poor working conditions (Alkhoraif and McLaughlin, 2018)
	Lack of worker empowerment (Bruno and Jordan, 2002; Lewchuk and Robertson, 1996)

Table 3.
Enablers of and barriers to the employee characteristics factors for first-line employees in lean implementation in small- and medium-sized enterprises

	Employee characteristics (competence/personal traits)
Enablers	Creativity and innovation (Darcy *et al.*, 2014; Saunders *et al.*, 2014; Yadav *et al.*, 2019a)
	Task rotation, training and reallocation (Majava and Ojanperä, 2017)
	Problem-solving demands and activities (Cullinane *et al.*, 2013; Huo and Boxall, 2018)
	Involvement in activities of checking, reporting and correcting eventual problems (Kull *et al.*, 2014)
	High level of affect-based trust and cognition-based trust (Li *et al.*, 2015; Bruce *et al.*, 2011); trust built through team activity (Roslin *et al.*, 2019; Shokri *et al.*, 2016)
	Knowledge-sharing (Eze *et al.*, 2013)
	Signs of improvements in lean implementation in a particular area within SMEs (Bakås *et al.*, 2011)
	Adaptable employees (Dombrowski *et al.*, 2010)
Barriers	Unused employee creativity (Majava and Ojanperä, 2017)
	Lack of confidence in the lean program (Ramadas and Satish, 2018a, 2018b)
	Resisting to lean (AlManei *et al.*, 2017; Antomarioni *et al.*, 2020; Antosz and Stadnicka, 2017; Mamat *et al.*, 2015; Ramadas and Satish, 2018a, 2018b; Salma *et al.*, 2018)
	Lack of knowledge of lean techniques (Rose *et al.*, 2013; Van Goubergen *et al.*, 2011)
	Lack of training and skills (Abu *et al.*, 2019; Moeuf *et al.*, 2016; Yadav *et al.*, 2019b)

et al., 2012). However, the literature has predominantly considered lean a technical toolbox concept and has paid less attention to the human factor and supporting culture (Andersson *et al.*, 2006; Delbridge, 2005). We identified several factors inside this theme that relate to the role of FLEs in lean SMEs.

5.1.1 Commitment (engagement). The success of lean implementation highly depends on the employees and their capabilities and willingness to commit to continuous improvement and development (Liker and Meier, 2007). Building a high level of commitment and engagement among workers is the primary determinant of successful lean implementation (Angelis *et al.*, 2011; Gatchalian, 1997; Shadur *et al.*, 1995). Lean introduces additional

demands on FLEs for identifying and solving the problems and greater responsibility for the quality, multiskilling, delegation of tasks and maintenance of the equipment (Bouville and Alis, 2014; Hernandez-Matias *et al.*, 2019). Although the delegation and decentralization of decision-making could enhance FLEs' motivations, workers might be unwilling or unprepared to take on such responsibilities, creating dissatisfaction and stress (Abolhassani *et al.*, 2016; Vidal, 2007). Moreover, greater cognitive demands, use of skills, production responsibilities and pressures on FLEs often offset the presumed benefits of higher autonomy and task variety (Hasle *et al.*, 2012; Jackson and Mullarkey, 2000; Thanki and Thakkar, 2014). Many FLEs are unprepared and reluctant to engage in problem-solving, decision-making and applying multiple skills. Forcing them to participate in those activities increases job-related strain and job dissatisfaction (Hopp, 2018; Vidal, 2007). Dissatisfied workers might exhibit counterproductive behavior or leave the firm (Bergquist and Westerberg, 2014). Negative job demands should be balanced with positive job resources to ensure proper employee engagement, as suggested by the job demands-resources model (Demerouti and Bakker, 2011; van Dun and Uittenbogaard, 2017).

5.1.2 Lean awareness program. A lack of awareness and training on the lean concept can introduce resistance because of a perception of an increased workload, fear of mistakes and

	Management involvement
Enablers	Management involvement (Achanga *et al.*, 2006; Gandhi *et al.*, 2018; Hu *et al.*, 2015; Mamat *et al.*, 2015; Yadav *et al.*, 2019a)
	Top and middle-management commitment (Alefari *et al.*, 2017; Hernandez-Matias *et al.*, 2019)
	Top management support (Glover *et al.*, 2011; Caldera *et al.*, 2019), first-line manager support (Huo *et al.*, 2019)
	Feedback (Kull *et al.*, 2014; Mehta and Shah, 2005)
	Assigning responsibility and using tools for making decisions (Hallstedt *et al.*, 2013)
	External support from consultants (AlManei *et al.*, 2017)
Barriers	Lack of management commitment (Jobin, 2015; Yadav *et al.*, 2019b; Mamat *et al.*, 2015)
	Lack of communication between workers and supervisors (Yadav *et al.*, 2019b; Ramadas and Satish, 2018a, 2018b)
	Lack of knowledge about existing specialists in lean areas (Ramadas and Satish, 2018a, 2018b)

Table 4. Enablers and barriers of management involvement factors for first-line employees in lean implementation in small- and medium-sized enterprises

	Lean job design
Enablers	Communication (Puvanasvaran *et al.*, 2009)
	Enhanced job resources to boost the motivational potential (Cullinane *et al.*, 2014)
	Reward system (Moeuf *et al.*, 2016) and recognition (AlManei *et al.*, 2017; Mohammad and Oduoza, 2019)
	Financial rewards (Bhamu and Singh Sangwan, 2014)
Barriers	Not informing workers of lean strategies and miscommunication (Bhamu and Singh Sangwan, 2014; Worley and Doolen, 2015)
	Low skill levels of employees (Yadav *et al.*, 2019b),
	Increases in workplace intensity related to lean (Anderson-Connolly *et al.*, 2002; Bouville and Alis, 2014)
	Higher workload and role overload (Brännmark and Holden, 2013)
	Work intensification (Huo *et al.*, 2019)
	Lack of proper recognition (Bocquet *et al.*, 2019)
	Lack of suitable reward systems (Sahoo and Yadav, 2018)

Table 5. Enablers and barriers of lean job design factors for first-line employees in lean implementation in small- and medium-sized enterprises

job loss (Vilda *et al.*, 2019). Employees occupying first-line positions with greater direct involvement in lean usually have a perception bias, provoking a greater perception of barriers (Antomarioni *et al.*, 2020). Sufficient training in lean is the backbone of the implementation process, although SMEs often fail to provide systematic, professional training for the workers (Ramadas and Satish, 2018a, 2018b). SMEs also often rely on informal in-house training and self-education without engaging a significant number of external consultants or lean experts (Kumar and Antony, 2008; Yadav *et al.*, 2019b). Insufficiently and inappropriately trained FLEs will hardly understand the lean philosophy and fundamentals (Chen and Meng, 2010), a crucial precondition for commitment to and involvement in lean. Moreover, a lack of awareness of proper health and safety procedures in lean SMEs could result in poor working conditions (Alkhoraif and McLaughlin, 2018).

5.1.3 Involvement in teamwork. Efficient teamwork provides additional emotional support for workers, who feel respected, empowered and involved (Shokri *et al.*, 2016). The team-based work structure demands multiskilled, flexible and engaged workers (Bayo-Moriones *et al.*, 2008) who take greater responsibility for various tasks and can rotate across multiple positions (Åhlström and Karlsson, 1996; de Treville and Antonakis, 2006). Giving autonomy to workers unprepared or unwilling to self-manage their work in group settings can lead to frustration in workers and lengthy decision-making processes (Scherrer-Rathje *et al.*, 2009). FLEs in SMEs should be equipped with better team problem-solving capabilities because they usually transfer information and responsibilities less precisely (Gélinas and Bigras, 2004).

Individual workers' uneven contributions and involvement may lead to resentment and decreased efficacy of lean teams (Procter and Radnor, 2014). This is especially important for inexperienced shop-floor workers in SMEs, who might not be given a chance to be involved in decision-making or problem-solving (Che Mamat *et al.*, 2014), calling for careful involvement and "respect for workers" (de Treville and Antonakis, 2006). At the heart of lean production, teamwork allows employees to receive feedback, share issues and provide support (Conti *et al.*, 2006). Hence, sharing responsibility with coworkers can lead to greater worker involvement in lean (Longoni *et al.*, 2013).

5.1.4 Empowerment. FLEs in SMEs are mainly deployed in day-to-day operations, creating a need to empower them and ensure a supportive organizational culture (Panizzolo *et al.*, 2012). Vidal (2007) defined employee empowerment in lean as delegating authority to workers by increasing their skills, abilities, responsibilities and capacities for decision-making, problem-solving and continuous improvement. In large enterprises, employee empowerment should be especially accentuated in later stages of lean implementation, when the need for adequate routine emerges (Netland, 2016). In SMEs, on the other hand, employees should also be empowered to design lean policies and later influence everyday decisions (Marin-Garcia and Bonavia, 2015).

5.1.5 Characteristics of culture. Some characteristics of natural cultures, such as power distribution, degree of interdependence, uncertainty avoidance and social norms, introduce differences in lean implementation (Bortolotti *et al.*, 2015). Thus, before beginning to implement lean in SMEs, managers should carefully study and consider organizational and national characteristics that might affect its adoption (Kull *et al.*, 2014; Wangwacharakul *et al.*, 2014). For example, creating high-performing idea systems shifts the organization towards a "lean culture." Emphasizing the importance of small ideas allows for daily, continuous improvements and promotes quick organizational learning (Robinson and Schroeder, 2009). This is especially beneficial in SMEs, as these ideas are easier and simpler to implement and often do not require high investments. FLEs see and experience the impact of their participation, and this kind of supportive organizational culture creates a circle of

ongoing improvements. On the other hand, cultures characterized by individualism, power distance and uncertainty avoidance might introduce uncertainty among FLEs who feel threatened by ambiguous or unknown situations or unprepared for cross-functional team collaboration and job rotation (Kull *et al.*, 2014; Wangwacharakul *et al.*, 2014). Lean tools should be adapted to the specifics of the context, and lean should be seen as a direction, not as a state to be attained after implementation (Åhlström and Karlsson, 1996; Cullinane *et al.*, 2013; Eswaramoorthi *et al.*, 2011).

5.2 Theme 2: employees' characteristics

Employees' characteristics are essential determinants for their empowerment and participation in lean initiatives and implementation success because the collective change is a composite of individual firm members' activities. Individual readiness for change is "a mindset that exists among employees during the implementation of organizational changes" and encompasses their beliefs, attitudes and intentions about the need for the change initiative and the firm's capability of undergoing such change (Armenakis *et al.*, 1993). It is an essential resistance precursor to supporting lean implementation (Vakola, 2014). Although some employees might support lean implementation as a change to improve their work and benefit their work status, others might feel distressed and formulate negative attitudes toward the change (Conti *et al.*, 2006). For instance, shop-floor workers might perceive lean as more controlling and coercive than empowering and liberating, introducing resistance to change (Losonci *et al.*, 2017). Moreover, workers with low growth needs prefer stable and routine work (Angelis *et al.*, 2011). The difference in attitudes toward change is contingent on some employees' characteristics, such as coping styles, motivation, personality traits and gender (Vakola, 2014). For instance, shop-floor employees might have lower self-esteem, decreasing their openness to change (Bhamu and Singh Sangwan, 2014; Judge and Hurst, 2007). Thus, supervisors should be aware of the effect of individual differences on the reaction to change (Afsar and Masood, 2018; Hofstede, 1980) and inspire workers through transformational leadership.

5.2.1 Creativity. Huo and Boxall (2018) found creativity essential for workers' participation in problem-solving and continuous improvement. In SMEs, FLEs are expected to engage and actively participate in work-process design by providing creative solutions to potential issues (de Haan *et al.*, 2012; Yadav *et al.*, 2019a). However, creative thinking is not possible without job-relevant knowledge that is sufficiently rich to allow further exploration and recombination of the stored knowledge and information (Amabile *et al.*, 1996). Hence, inductive–deductive reasoning in SMEs (e.g. quality management projects, training, knowledge-sharing or cross-functional teams) could encourage employees' creative thinking (Kumar *et al.*, 2014).

5.2.2 Confidence. Employees' lack of confidence in lean is an important barrier in lean manufacturing in SMEs (Ramadas and Satish, 2018a, 2018b), mainly because of a lower level of knowledge and expertise in using advanced technical and statistical tools (Thomas and Barton, 2006). Therefore, creating a supportive organizational culture in lean SMEs is essential to ease workers' fears and increase their confidence (Ramadas and Satish, 2018a, 2018b). A pilot implementation should be designed and implemented carefully to prevent employees' dissatisfaction and loss of confidence in the program (Marvel and Standridge, 2009).

5.2.3 Resistance and trust. First-line SME employees confronted with the changing working conditions usually react with greater resistance than employees in managerial positions (Antomarioni *et al.*, 2020; Dombrowski *et al.*, 2012; Salma *et al.*, 2018). A lack of appropriate training and knowledge on the lean concept and related objectives, tools and

techniques has been recognized as the main reason for resistance among workers in lean SMEs (Bakås *et al.*, 2011). By understanding why workers resist, firms can act to decrease fear and increase trust in the program (Lodgaard *et al.*, 2016; Longoni *et al.*, 2013). This can be done by providing upfront comprehensive information and sufficient training on the change program, correcting misunderstandings and more actively including workers' ideas for meeting their needs and counteracting self-interest, fear and a low tolerance for change (Bruce *et al.*, 2011). Moreover, intensive communication through a lean awareness program and including shop-floor workers and their supervisors in generating ideas and needs will decrease fear and increase trust in the program (Bhamu and Singh Sangwan, 2014). Trustworthy and supportive managers will additionally support the acceptance of change among workers (Burawat, 2019; Cullinane *et al.*, 2017; Mohammad and Oduoza, 2019).

5.2.4 Motivation. FLEs work in environments (contexts, tasks and responsibilities) that differ from managers and have different motivational systems (Huber and Brown, 1991; de Treville and Antonakis, 2006). In lean generally, being exposed to stressful situations often leads to lower motivation, and ill-motivated employees may bring a downfall to lean implementation (Parker, 2003). On the other hand, FLEs in SMEs enjoy greater autonomy in the work delivery, supporting higher levels of learning and motivation (Sterling and Boxall, 2013). SME managers have a greater responsibility to support employees and prevent motivation decline (Yadav *et al.*, 2019b). External supervision and peer pressure also motivate workers to keep investing efforts in lean initiatives (Bakås *et al.*, 2011). Unlike SMEs, large enterprises (LEs) may have plentiful HR practices that counteract the decreasing motivation (de Treville and Antonakis, 2006).

5.2.5 Knowledge and skills. A particular challenge to lean implementation lies in workers' technical knowledge of their workplaces (Abu *et al.*, 2019). In SMEs, the dominant category of knowledge is tacit knowledge, accumulated over time through experience and information exchange with coworkers (Dombrowski *et al.*, 2012; Mohd Zahari *et al.*, 2019). For instance, workers learn from past defects and use this experience to prevent new ones in case of repeated orders, which helps in waste reduction (Eswaramoorthi *et al.*, 2011). However, while collaborative learning and knowledge dissemination are promoted because of the flat structure of SMEs, they often face resource limitations that affect the workers' knowledge and skills (Pearce *et al.*, 2018). Thus, in-house training and self-education are predominant knowledge transfer methods in SMEs instead of external consultancy in LEs (Kumar and Antony, 2008; Mourtzis *et al.*, 2016; Stanica and Peydro, 2016). Furthermore, SMEs' skills shortage and employee turnover make the knowledge creation and transfer processes more demanding because lean activities require skill variety, broad scope for action and similar demands (Coetzer *et al.*, 2017).

5.2.6 Adaptability. The sustainability of lean in the long run depends on employees' adaptability to new tasks, technologies and procedures (Sony and Mekoth, 2019). Formal communication, participative practices and dynamic training programs foster the willingness to adapt to lean practices (Bocquet *et al.*, 2019), optimal when employees begin to grow in their roles, usually after two years of implementing lean (Carlsson and Aronsson, 2017).

5.3 Theme 3: management involvement

The success of lean implementation in SMEs requires management's consistent financial support, clear improvement vision, active involvement and commitment to a long-term improvement philosophy (Bhamu and Singh Sangwan, 2014), even at short-term financial losses (Liker and Meier, 2007). Thus, a medium-sized firm takes a minimum of five years to

go through the lean transformation (Ohno, 1988; Womack, 2007), which requires long-term commitment and considerable managerial effort.

5.3.1 Management commitment to lean. Management support and commitment are often listed as critical success factors for successful lean implementation in SMEs (Achanga *et al.*, 2006; Hernandez-Matias *et al.*, 2019; Thanki and Thakkar, 2014). Although the mere presence of top management support is not enough, it is necessary to sustain the implementation of lean initiatives in SMEs (Worley and Doolen, 2015). Line managers should serve as engaging leaders who inspire their subordinates, granting them responsibility, autonomy and feedback and encouraging collaboration and teamwork (Netland, 2016; Schaufeli *et al.*, 2009).

5.3.2 Communication of lean strategy. Communication of managers' visions, understanding and experiences with shop-floor workers is of utmost importance in creating satisfactory awareness, trust and confidence among the workers (Burawat, 2019; Mohammad and Oduoza, 2019). SMEs have fewer hierarchical levels, allowing greater flexibility and adaptability to changes (Shokri *et al.*, 2016). Less-rigid hierarchy in SMEs allows closer communication among managers and employees, fostering trust-building in the methodology (Dora *et al.*, 2016). However, miscommunicating about lean strategies can provoke confusion among workers about their roles and responsibilities in the lean change initiative and eventually cause resistance to change (Andrew and Sofian, 2012; Puvanasvaran *et al.*, 2009). At the same time, a lack of communication makes workers feel undervalued and unwilling to participate in process improvements (Bruce *et al.*, 2011). The latter might be more present in defensive cultures, where FLEs feel "blame" for defects or errors (Cadden *et al.*, 2020), and this might be applied even more strongly in SMEs because feedback is more direct (Conti and Gill, 1998; Delbridge *et al.*, 1992).

A lack of understanding of lean objectives among shop-floor workers can lead to difficulties getting precise operational data from workers (Bhamu and Singh Sangwan, 2014). Two-directional formal and informal communication between workers and managers in SMEs can enhance employee engagement (Hilton and Sohal, 2012; Worley and Doolen, 2015). Lean principles and practices need to be communicated carefully to prevent the perception of prioritizing pure efficiency while being careless about workers' well-being (Gambatese *et al.*, 2017).

5.3.3 Manager–first-line employees relationship. Alefari *et al.* (2017) raised the importance of hierarchical employee engagement, where top managers engage their immediate subordinates, and this process trickles down to shop-floor employees through training, coaching and mentoring. Considering the flatter organizational structure and more effortless communication in SMEs, some authors have emphasized the importance of the commitment and knowledge of managers who directly communicate with FLEs (Jobin, 2015; Pearce *et al.*, 2018). Moreover, managers can help FLEs overcome the limitations of poor understanding through close collaboration in explaining the lean methodology (Adam *et al.*, 2020; Huo and Boxall, 2018).

5.3.4 Support (information feedback, receptiveness to suggestions and external support). Managers play an essential role in understanding work stressors and supporting FLEs to help them cope with increased work demands and protect their well-being (Bruno and Jordan, 2002; Huo and Boxall, 2018; Ng and Sorensen, 2008). Direct and clear supervisor feedback on process performance decreases role ambiguity through goal clarification, preventing lean-related strain (Delbridge, 2005; de Treville and Antonakis, 2006), improving job satisfaction and decreasing the turnover intention of FLEs in lean SMEs (Huo *et al.*, 2019). Huo and Boxall (2018) found that the negative effect of lean's additional problem-solving demands on engagement and well-being is significantly buffered by sufficient

training, workers' involvement in decision-making and first-line manager support. Furthermore, support through external consultants allows easier lean implementation because of their deeply specialized knowledge and experience (Kumar and Antony, 2008; Yadav *et al.*, 2019a).

5.4 Theme 4: lean job design

Managers should use different HR practices (training, contingent compensation and flexibility) to align individual workers' interests with those of the firm implementing lean to assure continuous discretionary efforts (Molina *et al.*, 2004). Existing research has confirmed the importance of the soft side of management for intentions to engage in continuous improvement and learning (Koo *et al.*, 2014).

5.4.1 Work design. Jackson and Mullarkey (2000) suggested a need for balance or "creative tension" between the positive (e.g. empowerment and engagement) and adverse effects (e.g. problem-solving and work demands) of lean's introduction to workers, which depends on management choices for work design (Lee, 2004). For example, highly skilled workers might find cleaning and maintenance of machine environments undignified burdens (Singh *et al.*, 2013). Job rotation reduces repetitive activities (Womack, 2007) and alleviates boredom and monotony (Gnanavel *et al.*, 2015). Some authors, however, have related job rotation to a lower level of job satisfaction and intent to stay (Bouville and Alis, 2014). Some shop-floor workers might resist flexible work because of the fear of eroding their skills and bargaining power (Cartwright and Cooper, 1997). On the other hand, standardization can reduce the autonomy and freedom of FLEs (Hasle *et al.*, 2012). Overall, investing in employees' well-being and improved worker relations can counterbalance the high level of standardization and increased control (MacDuffie, 1995).

5.4.2 Work complexity and pace (work intensification). Job complexity and intensification often exhaust FLEs by depleting their energy and emotions, leading to health strain and dissatisfaction (Huo *et al.*, 2019). SMEs might have difficulties arranging sufficient labor, financial and time resources to support lean implementation, which additionally overburdens workers, leading to an unsustained commitment to lean (Abu *et al.*, 2019; Achanga *et al.*, 2006). Greater production pressures and the removal of slack because of work intensification can result in role overload and deteriorated worker health when FLEs cannot accomplish their given tasks or the required changes exceed performance capacity (Conti *et al.*, 2006; Kaminski, 2001; McLain and Jarrell, 2007).

5.4.3 Appraisal and rewards. Previous research has found differences among the motivators of FLEs and knowledge workers. Knowledge workers were much more motivated by autonomy and work content (Harris and Locke, 1974; Ronen and Sadan, 1984), whereas shop-floor workers were motivated by financial rewards and job security. This is in line with the critique by Vidal (2007), who noted the assumptions that FLEs are empowered and involved in lean just because the intrinsic rewards of job enrichments are regularly oversimplified, neglecting or omitting the importance of extrinsic rewards; thus, workers expect intrinsic awards to complement extrinsic awards rather than a substitute for them. The lack of a proper reward policy can be a significant barrier at the shop-floor level (Abolhassani *et al.*, 2016). These cultural and hierarchical differences should be considered in designing rewards and recognition schemes (Netland, 2016). FLEs might perceive lean as extra work without additional financial reward (Burawat, 2019).

Moreover, lean is often characterized by performance outcomes that are difficult to measure, and performance benefits usually occur over a relatively long time; therefore, softer reward practices, such as ongoing recognition and praise, might be helpful in the initial stages of lean implementation (Netland *et al.*, 2015). Providing a clear link between the

intrinsic and extrinsic awards for meeting lean strategic objectives (Jazayeri and Hopper, 1999; Netland *et al.*, 2015) has been found to improve employee commitment and satisfaction significantly and decrease the employee turnover rate, which is regularly an issue in SMEs (Panizzolo *et al.*, 2012; Ramadas and Satish, 2018a, 2018b). Research has found that FLEs prefer bonus financial payments to compensate for the increased work pressure and multitasking and prevent turnover (MacDuffie, 1995; Snell and Dean, 1994). Hence, free-rider behavior and poorly mixed teams might lead to well-performing group members losing motivation because they are not obtaining appropriate payment (Jones and Kato, 2012). This can be mitigated by introducing individual and collaborative team targets (Wickramasinghe and Wickramasinghe, 2016).

6. Discussion and future research avenues

Although previous research has emphasized the importance of the human factor for successful lean adoption (Losonci *et al.*, 2017; Pearce *et al.*, 2018), extant literature is fragmented with a partial understanding of FLEs' behaviors and relevant contextual factors (Hu *et al.*, 2015; Schmidt, 2011), specifically focusing on SMEs. Considering FLEs as the primary source and driver of successful lean adoption in SMEs (Tsironis and Psychogios, 2016), this literature review provides a comprehensive summary of FLEs' roles in lean implementation in SMEs. The four main themes and their underlying factors, identified through content analysis, present building blocks in developing a lean implementation model for SMEs that comprehensively consider FLEs' roles.

Successful lean implementation requires high commitment and engagement from FLEs, which builds upon supportive management, sufficient and appropriate training and education, careful involvement in problem-solving and decision-making with a balanced job demands-resources design and suitable appraisal and reward systems. FLEs often perceive lean as extensively controlling and coercive with inappropriate demands for technical knowledge and problem-solving skills, causing fear, loss of confidence and resistance to the implementation (Antomarioni *et al.*, 2020; Che Mamat *et al.*, 2014; Conti *et al.*, 2006; Shokri *et al.*, 2016). A lean awareness program, sufficient training and engagement with external consultancy support the understanding of the lean philosophy and fundamentals and raise FLEs' motivation and confidence as a precondition for commitment and engagement to lean (Longoni *et al.*, 2013; Vidal, 2007; Vilda *et al.*, 2019). Considering the flat hierarchy of SMEs, line managers could empower FLEs by encouraging collaboration and teamwork and providing communication without blame for errors (Cullinane *et al.*, 2017; Panizzolo *et al.*, 2012; van Dun and Uittenbogaard, 2017). The lean job design requires participative involvement of FLEs to balance demands-resources tension, preventing job strains and turnover (Demerouti and Bakker, 2011; de Treville and Antonakis, 2006; Vidal, 2007). A proper reward policy should be set considering FLEs' characteristics, providing intrinsic rewards (e.g. recognition and praise) in the initial phase of lean implementation and extrinsic awards (e.g. pay raises, bonuses and benefits) in the ensuing phases (Marin-Garcia and Bonavia, 2015; Netland *et al.*, 2015; Ramadas and Satish, 2018a, 2018b).

This research identified four main themes and their underlying factors related to FLEs' role that should be considered for a successful lean implementation in SMEs. The main challenge in theme and factor identification was the extraction of themes and factors that can be discriminately defined, as the themes and factors are connected and exhibit synergistic, complementary cause-and-effect relationships. Many examples of these relationships have been presented within descriptions of factors and are clearly shown in the lists of enablers and barriers. Strong interrelationships between the themes and factors indicate that possible overlaps among factors should be considered in further research and

potentially enable factor purification. Further research should study synergies and cause-and-effect relationships among various factors (from the same theme and different themes) and identify how activities used as enablers for the improvement of certain factors could also act as enablers for improvement of other factors. Therefore, the interplay between the themes and their factors should be researched. For example, how do cultural change factors affect employee characteristics and vice versa? How do organizational approaches related to changing the culture within an organization have to consider employees' characteristics, and how do they dynamically change these employees' characteristics?

On the other hand, managers' roles in changing culture are crucial, and job design must integrate desired cultural changes and individual employee characteristics. Therefore, the identified themes and underlying factors can serve as a basis for further exploratory and confirmatory research on the importance, relevance and relationship among them in various settings and develop suitable measurement scales for further assessment of preparedness and effectiveness of lean implementation. In addition, research should clarify how contexts affect their appropriateness, validity, importance and relationships.

We identified several enablers and barriers mentioned in previous research based on the content analysis. However, further work is needed to develop appropriate classifications of enablers and barriers for each of the identified four themes and specific factors within the themes. Enablers and barriers should also be related to different phases of lean implementation regarding their importance for successful pre-implementation, implementation and post-implementation phases. Such classifications of enablers and barriers would provide guidelines to be considered by practicing managers in different phases of lean implementation and enable the development of enablers and barriers measurement criteria and scales.

Next, using a variety of lean methodologies requires further distinction of common and various enablers and barriers with the identification of suitable management practices for lean SMEs. Our research could serve as a groundwork to develop general guidelines for lean implementation in SMEs considering employees' roles (like existing similar methodologies, TQM or Six Sigma). Moreover, the lack of empirical exploration of employees' roles in lean implementation requires further empirical effort to research the enablers and barriers in different empirical settings (e.g. hierarchy, industry type, strategy and leadership).

We also propose further research efforts to develop performance criteria to evaluate operational and financial benefits over lean SMEs' pre-implementation, implementation and post-implementation phases. Many benefits related to employees' roles in lean implementation are intangible (e.g. employees' motivation, satisfaction, creativity and innovation) and indirectly affect lean implementation's operational and financial benefits by creating a supportive environment, so their consideration would substantially improve the current understanding of benefits. Moreover, additional research attention could be paid to comparisons between SMEs and large organizations that are more extensive, considering the various complexities of processes, strategies and cultures, which was out of scope for this study.

Descriptive analysis shows that, despite the exponential growth of research on employees in lean SMEs' implementation, most studies have predominantly relied on case study methodology, addressing SMEs in particular contexts (e.g. Europe and manufacturing industry). Applying ethnographic studies, grounded theory, action research or mixed methods can provide additional in-depth insight into critical employee-related factors in lean SMEs. As cultural context has been identified as crucial for lean implementation, future studies should focus on less developed countries with significantly different settings – the findings from developed countries might have limited transferability

and relevance. Previous research on lean in SMEs mainly addressed the manufacturing sector; therefore, a prominent research stream would be a more profound consideration of lean SME implementation in the service industry (e.g. banking, health care and education), providing a basis for cross-sector comparison considering relevant organizational, technical and cultural factors.

6.1 Practical implications

Our work has several practical implications for managers implementing lean in SMEs. Results show that themes and their factors related to the role of FLEs in lean implementation are interrelated. Therefore, managers need to simultaneously design programs that consider cultural change factors, employees' characteristics (competence/personal traits), management involvement and lean job design. Initial lists of enablers and barriers identified based on previous research can be used by practitioners as guidelines for more successful lean implementation in SMEs through exploiting enablers and overcoming barriers.

Results show the importance of FLEs' active participation in improvement activities, requiring a careful rethinking of cultural aspects that might affect the technical and operational implementation of the lean program (Dombrowski and Mielke, 2014). In addition, managers should consider FLEs' characteristics carefully because they work in a different context than managers at higher hierarchical levels (different work environments, motivation systems and responsibilities) (Huber and Brown, 1991). Hence, supportive and transformational leadership will foster the acceptance of lean among workers through greater confidence in the program and psychological safety.

Lean has been criticized in terms of the increased demands and pace of work, short training requirements, lack of flexibility, exploitation of workers and related negative consequences on employees' motivation, well-being and commitment (Boyle and Scherrer-Rathje, 2009; Niepce and Molleman, 1998; Williams *et al.*, 1992). Thus, SMEs' management must provide sufficient financial, time and learning resources to prevent overburdened workers and inconsistent lean commitment. Moreover, we emphasize the importance of job design for maximizing positive interactions between FLEs to sustain motivation and efficiency. In addition, differences in motivators among FLEs should be considered when establishing a reward policy. Nevertheless, it is crucial to consider lean implementation a long-term journey requiring cultural changes that are highly dependent on the specifics of the context.

6.2 Limitations and conclusion

Besides the tremendous growth of literature related to lean implementation in the past two decades, there is a persistent lack of focus on the role of human factors in lean implementation in SMEs. Our study provides a comprehensive literature review on the role of FLEs in lean implementation in SMEs and identifies related themes, such as cultural change factors, employees' characteristics, management involvement and lean job design. The study suggests developing a balanced demands-resources job design for FLEs to ensure proper motivation, engagement and commitment to lean. Nevertheless, individual FLEs' peculiarities and cultural characteristics need to be considered when assessing the preparedness and effectiveness of lean implementation in SMEs.

A potential limitation of this study is the failure to access and discover relevant literature on the topic. By relying on broad search terms and the most extensive databases, we tried to find the most relevant literature on the topic. We do not rule out the possibility that we missed a small portion of the relevant literature, but we do not expect these papers would dramatically affect the results. In addition, we attempted to limit researcher objectivity in the thematic analysis by using qualitative software for coding and categorizing. Still, we

cannot preclude some element of subjectivity in some coding decisions. By identifying the key themes, we have provided a guide and research agenda for researchers to analyze and enrich the existing evidence and a reference for more successful lean implementation.

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Corresponding author

Katerina Božič can be contacted at: katerina.jovanovska@ef.uni-lj.si