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► To cite this version:

Florian Magnani, Ali Siadat, Emmanuel Caillaud, Olivier Gaudichau. Defining lean experts' roles and behavioral competencies during lean adoption: a case study of Groupe PSA. TQM Journal, 2023, 10.1108/TQM-01-2023-0011 . hal-04072161

HAL Id: hal-04072161

<https://hal.science/hal-04072161>

Submitted on 5 Apr 2024

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Defining lean experts' roles and behavioral competencies during lean adoption: a case study of Groupe PSA

Florian Magnani*. Ali Siadat**
Emmanuel Caillaud***
Olivier Gaudichau****

** Aix Marseille Université, CERGAM, Aix-en-Provence, France
Ecole Centrale de Marseille, Marseille, France*

*38 Rue Frédéric Joliot Curie, 13013 Marseille, France
(Tel: +3367-975-7921; e-mail: florian.magnani@centrale-marseille.fr)*

***LCFC Laboratory, Arts et Métiers ParisTech, Metz, France*

**** LIRSA Laboratory, Conservatoire National des Arts et Métiers, Paris, France*

***** Lean expert & manager, PSA Group, Paris, France*

Abstract:

Purpose: Previous research has managed to clearly define lean technical competencies. However, the behavioral competencies remain underestimated, and the roles of lean experts are not clearly stated: are they teachers, facilitators, or technical experts? The present paper investigates lean behavioral competencies and their relationship to lean experts' roles.

Methodology: This article serves as an exploratory study built on interviews, observations, and focus groups conducted during a three-year longitudinal study accompanied by a three-year follow-up. The case takes place in an international automotive company in partnership with Toyota in which lean adoption was part of a consistent strategy over a period of 20 years.

Findings: The study clarifies lean behavioral competencies related to organizational efficiency (nominal management, improvement management, and respect for people) and relational efficiency (problem resolution, competencies development, and systemic interactions). The study helped create a typology of lean experts' roles related to the maturity level of the environment in which they intervened. Moreover, Lean experts' roles in congruence with the environment seem to positively influence the creation of emerging human relationships that are beneficial to process improvement and competencies development.

Originality: This paper is the first to clarify behavioral competencies with respect to lean experts' roles and to study the temporality of the introduction of lean practices. The findings recommend that researchers better acknowledge the influence of lean behavioral competencies during lean adoption and their relationship to contextual factors and organizational performance. A practical methodology is proposed to measure the necessary behavioral adjustments of lean experts or employees.

Keywords: Lean Management, Behavioral competencies, Organizational change, Socio-technical systems, Lean expert's role, Qualitative study

1. Introduction

Management of organizational change continues to be a vibrant topic of interest for researchers and practitioners. It encompasses a complex system that involves the flow of operations, information, and people. Lean has emerged as a complementary support in the coordination and improvement of the steps taken to efficiently manage organizational change (Dabhilkar and Åhlström, 2013). This explains the recent surge in lean research in a variety of fields: Production (Pettersen, 2009), Supply Chain (Tortorella et al., 2017b), Sustainability (Mårtensson et al., 2018), and Industry 4.0 (Saxby et al., 2020; Vinodh et al., 2020). An abundance of evidence supports a positive association between lean and operational or environmental performance (Liu et al., 2021). However, lean adoption without the soft (i.e. interpersonal) components, organizational culture, or contextual factors taken into account (Bortolotti et al., 2015; Dahlgaard and Dahlgaard-Park, 2006; Salentijn et al., 2021; Secchi and Camuffo, 2019; Tortorella et al., 2017b, 2018), has been known to generate varied outcomes. Lean practices are thus becoming increasingly challenging to adopt as products, services, and related operations are increasing in complexity. Although widely discussed, the understanding of lean organizational change has yet to reach its full potential. This is largely due to researchers and practitioners neglecting the impact of the human dimension on lean adoption (Salentijn et al., 2021; Wieland et al., 2016).

Researchers demonstrate that the presence or absence of human-related practices can make or break lean adoption (Bortolotti et al., 2015). Educating all members of an organization appears to be a necessary step towards lean adoption (Beauvallet and Houy, 2010; Fujimoto, 1999). For example, competency development practices such as training and teamwork help us understand how individual employees' appreciation of and adaptation to lean adoption differ (Salentijn et al., 2021). This employee education is mainly achieved by managers and lean experts (Warhurst, 2013) who work hard to create an environment that facilitates their employees' furthering education. Managers and lean experts inspire the utilization of lean practices by engaging employees in the collective improvement mindset featured in lean adoption (Alves et al., 2012). However, discussions about the relationship between managers or experts and their employees are often absent, on both individual and group levels, in lean literature. This observation calls for an exploration of the roles of individual agents and groups in decision-making models during lean adoption. As of today, few studies explore these behavioral dynamics within operation systems (Schorsch et al., 2017).

Reading through the lean literature, we found that a surprisingly wide variety of approaches have been taken with reference to issues related to lean adoption. Lean has evolved from a set of simple methods to a complex sociotechnical system (Dabhilkar and Åhlström, 2013). This evolution could explain the difficulties behind maintaining momentum during a lean adoption. Recent research discusses the direct influence that internal lean experts have on the adoption process (Danese et al., 2017; Herron and Hicks, 2008; Magnani, 2016), during which they are responsible for modifying and maintaining individual and group behaviors within the company (Battilana and Casciaro, 2012). Some studies focus on the influence these experts' formal roles have on the initiative of the adoption process. However, they largely overlook the influence of their informal roles within organizational networks during the adoption (Battilana, 2010). In addition, lean experts' roles are sometimes defined as teachers (Liker and Ballé, 2013), change agents (Herron and Hicks, 2008) or technical experts (Laureani and Antony, 2011). Because their roles are abstract during the adoption phase, it makes it more difficult to outline the expected competencies associated with lean practices from the perspective of an employee or an expert. This study aims to identify lean experts' behavioral competencies and focus on how these roles affect the transference of lean practices while fostering the company's successful lean adoption.

After reviewing the existing literature on lean practices, their related behavioral competencies, and lean experts' roles, we outlined our research objectives and the methodology used to conduct our research. The exploratory aim of our research allowed us to present preliminary results to build a theory on the lean practices and experts' role in disseminating these practices.

2. Literature review

2.1 Lean practices

Researchers usually define lean as a complex organizational innovation, one that has the same strategic significance as that of Taylorism but has since undergone a change and is now studied as its own separate type of innovation (Dankbaar, 1997; Womack et al., 1990). First, lean was viewed exclusively as a technical system (Niepce and Molleman, 1998) differing from mass production by its work design and quality. Then, relationships between lean and socio-technical theory were found (Dabhilkar and Åhlström, 2013), asserting that lean's social and technical subsystems interact simultaneously to improve both the operational and financial benefits of any given organization. The technical subsystem has been extensively studied, which explains why research

is able to provide a sound definition of the required technical practices of lean, such as pull system, quality control, preventive maintenance, standardized work, etc... (Cua et al., 2001; Dankbaar, 1997; Flynn et al., 1995). However, research on the social subsystem and its related lean practices is oftentimes reduced to human resources practices at an organizational level (Shah and Ward, 2007, 2003). In fact, research on Operation Management is often conducted solely on an organizational level (Wieland et al., 2016), leaving the human-related features of the social subsystem on an individual level underestimated.

Looking at the individual level, the lean literature exposes the technical practices while assessing the degree of practice adoption or their relationship with organizational performance. Shah and Ward (2003) acknowledged significant lean practices and categorized them into Just-In-Time (JIT), Total Quality Management (TQM), Total Preventive Maintenance (TPM), and Human Resources Management (HRM) bundles. Their model was improved by including supplier and customer improvement practices (Shah and Ward, 2007). Based on these findings, it was observed that the 10 most studied lean practices related to JIT, TPM, TQM, and HRM represent nearly 80% of the practices adopted by organizations (Negrão et al., 2017). Surprisingly, HRM practices are frequently discussed in the literature as an intensifier of the adoption (Bortolotti et al., 2015; Salentijn et al., 2021) but these practices were not fully described: they are often summarized as employee involvement practices, employees' roles in problem-solving and cross-functional activities (Bortolotti et al., 2015; Cua et al., 2001; Flynn et al., 1995; Shah and Ward, 2007). In addition, even if the lean practices are defined exhaustively, they are not differentiated in terms of the members of the organization that should adopt these practices.

2.2 Lean competencies

In many professional fields, certifications help researchers and practitioners assess sets of competencies associated with useful practices. Oftentimes, certification is obtained through a standard set of education, and experience requirements, typically evaluated by a central authority to assess professional competencies. What makes lean competencies assessment difficult is that it often lacks a legitimate central authority. Because there is no frame of reference, lean education vastly differs in length and content between experts and organizations (Dabhilkar and Åhlström, 2013). Therefore, it engenders difficulties in the comparison of professional competencies levels associated with lean. Laureani and Antony (2011) proposed a standard for Lean Six Sigma

certification, mainly rooted in technical competencies. Lean and Six Sigma are often merged which makes it difficult to assess lean competencies as a single entity. Focusing solely on lean, the studies conducted by Liker and Hoseus (2008), Liker and Trachilis (2015), Emiliani (2003), Seidel et al. (2017) and Kregel et al. (2019) were the ones that contributed the most to the identification of lean competencies. The competencies were explicitly presented even though these articles focused primarily on lean competencies for leaders. Moreover, the temporality of the lean competencies' development during adoption and the social progression of these competencies were not mentioned.

Table I details all the lean technical and behavioral competencies found in the literature and their relationship with lean practices previously mentioned in the article. The “commit to self-development” competency, found in the literature written by authors of Toyota Way (Liker and Trachilis, 2015), is often absent in lean research: only articles related to Toyota tried to capture interactional competencies associated with lean practices. The difficulty lies in the way in which Toyota practices have intertwined technical with interactional competency development. For example, employees keep pushing themselves to continuously develop their knowledge, with specific regard to standardization, systematic problem-solving, and communication competencies (Maginnis, 2013). Thus, lean experts intend to transfer lean competencies, which have two fundamental purposes: to equip employees with the means to improve their tasks and to self-develop (Liker and Ballé, 2013). By looking at job positions, Kregel et al. (2019) identified a taxonomy of lean professionals' competencies but failed to define a taxonomy of behavioral competencies.

Table I. Lean practices and associated lean competencies found in the literature.

Please insert Table I

2.3 Lean experts' roles

Identifying and analyzing employees' behaviors during their lean practices helps to define lean behavioral competencies. Lean research focuses on managers' behaviors in lean contexts (Camuffo and Gerli, 2018; Emiliani, 2003; Secchi and Camuffo, 2019) but, to our knowledge, there are no articles in which lean experts' behaviors are described. Lean experts' behaviors seem rooted in strong hands-on knowledge and their ability to identify teachable moments when they arise (Ballé, 2016). These experiences highlight the lean expert's role in developing what Drucker (1959) called

“Knowledge work”. Knowledge workers are those employees who are responsible for exploring and generating concepts rather than concentrating solely on implementing or managing existing processes. Generally, knowledge workers have high degrees of expertise, education, and/or experience and the primary purpose of their job involves the creation, distribution, or application of knowledge. Knowledge workers conduct non-routinized problem-solving practices that require a combination of convergent, divergent, and creative thinking (Reinhardt et al., 2011). This perspective on the lean expert’s role is aligned with Laureani and Antony's (2011) research that defines lean experts as technical experts.

Current research is expanding the role of experts in organizations, whether it is to define the content of their knowledge, currently more interactional than technical (Johri, 2015), or to define the scope of their influence and action (Collins and Evans, 2007). From a technical perspective, lean experts begin as process configurators and eventually become process controllers (Holmemo et al., 2018). In contrast, from a more interactional perspective, lean experts’ roles are first and foremost about organizational change, followed by collective organizational learning (Herron and Hicks, 2008). This is demonstrated through recent research which shows that human-oriented lean interventions have more favorable employee outcomes (Bortolotti et al., 2015; Longoni et al., 2013). In this case, they share “change agent” characteristics as they perform actions that propel the lean adoption (Weick and Quinn, 1999) while employees and managers act as the change recipients. These characteristics are found in the literature (Bortolotti et al., 2015; Tortorella et al., 2017) but the degree to which the lean experts' behaviors are intentional has not been explained.

Research focusing on Toyota contends that lean experts embody a "teacher" role, using every opportunity to develop people, engaging in knowledge transfer without giving the answers, and motivating people without being punitive (Liker, 2004; Liker and Hoseus, 2008). They are usually called “sensei” (Reke et al., 2020) which is defined as “*a master of lean knowledge as a result of years of experience in transforming the gemba (i.e. the environment in which they intervene)*”. Compared to technical experts, a sensei’s expertise is needed to solve open problems, meaning problems that are complex to define and lack a known solution. Faced with open problems, these sensei support managers, and employees as they explore potential issues by tackling several smaller, closed problems. Over time, managers are expected to connect the dots between the sensei’s teachable moments (Ballé, 2016) that consequently help them find operational solutions. However, except for the description based on the authors of Toyota Production System, these sensei

or Lean experts' interactions with managers and employees are entirely absent in the current literature. Oscillating between knowledge worker and change agent characteristics, the varieties of the lean expert's role found in the literature (cf. Table II) make it difficult to define its associated behavioral competencies.

Table II. Lean experts' roles definitions presented in the literature.

Please insert Table II

3. Research question

The current literature allowed us to describe lean practices and their associated technical competencies, though not always as clear as one would hope, but still lacked a precise description of its behavioral competencies. By studying lean experts who embody these technical and behavioral competencies, we hope to gain a greater understanding of the influence that lean experts and their behavioral competencies have during lean adoption. In doing so, we aim to propose a framework of internal lean experts' roles in a company context related to lean adoption progress.

Considering the lean adoption process within an organization as the result of a collective and cumulative learning process driven by employees (Magnani, 2016), it seems appropriate to explore the behavioral role of individual agents within an organization. Taking micro-interactions displayed by lean experts as the starting point and having them transfer the necessary knowledge to the organization (Danese et al., 2017; Herron and Hicks, 2008), our research question is: what are the lean experts' roles and competencies used during the lean adoption? Through an exploratory approach, this article intends to fulfill the following two goals: (1) to clarify lean behavioral competencies and (2) to depict lean experts' roles regarding the transfer of these behavioral competencies.

4. Methodology

The scarcity of research on this subject directs our research towards an inductive theory-building process (Eisenhardt and Graebner, 2007) to identify a collective understanding of lean experts' roles (Stake, 1995). To study the specific behavioral competencies of lean experts and their roles during lean adoption, we chose to observe the interactions lean experts had with the organization's managers. We also discussed our observations with the lean experts to challenge these observations to come to a collective consensus.

The case considered in this study is Groupe PSA, an international automotive company, where lean adoption was part of a consistent strategy over a period of 20 years. This process can be illustrated in five different phases: initiation, generation, diffusion, unification, and reconfiguration (cf. Magnani, 2016). During these phases, the adoption's scope evolved as well as lean experts' roles. At first, lean experts helped identify and align the best practices. Then, they offered training and support to the departments of interest. At that time, the network of lean experts was extensive: lean experts' teams started to form in the Manufacturing, Research & Development (R&D), and Sales & Marketing (S&M). Groupe PSA represents a remarkable case because of its steady history with lean adoption, its large network of lean agents, and its close relationship with Toyota since 2001. In this study, we take a closer look at lean experts' roles and focus on the three experts' teams attached to the following departments: Manufacturing, R&D, and S&M. These three departments had various lean experts' profiles and intervention approaches. Through this research, we intend to delineate the lean expert's behavioral competencies and the role they played during the lean adoption.

To get as complete a picture as possible of the phenomena, a case study approach was used (Stake, 1995), where data from different nature was collected. Since our research endeavor aims to develop new constructs about lean behavioral competencies, we opted for a case study research strategy involving triangulation among a variety of different sources of data (Cox and Hassard, 2005). This triangulation served as a clarification of perceptions, to construct a shared social reality and helped construct validity, in line with the coding process. This data includes formal and informal interviews with 21 internal lean experts, analysis of focus groups (7 meetings), and on-site observations of lean experts' interventions. These data are part of a three-year immersion research starting in January 2014 and ending in January 2017, combined with a follow-up with all experts involved that ended in December 2020. Lean experts and their interactions with employees represent the primary source of data and the unit of analysis during lean adoption. The purpose of the interviews and observations was to put into perspective experts' behaviors within their words and to analyze social interactions. Through interviews and focus groups, we qualitatively evaluated experts' competencies and roles. An inductive study, based on daily observations for the purpose of developing a theory, even if suggestive, allowed us to enrich our sources of data and their nature. The reflexive turn generated by observations and their shared understanding ensures a complete

and complex narrative approach in developing or reinforcing the findings (Klag and Langley, 2013).

Our first source of data was collected through observations and immersions. A total immersion over the course of three years allowed us to participate with the internal lean experts' teams in the three considered departments, including visits to factories. In addition to these immersions, expert observations have been made: their daily activities, their interactions, and actions they have taken with employees and managers, their training sessions, and their participation in strategic meetings. The observation methodology is as follows: we carried out non-participating and floating observation phases to identify recurrent actions and behaviors. This informal methodology made it possible to move towards establishing more structured rules, which we were able to reuse in controlled observation situations, to build a shared understanding. The goal was to observe social configurations in the most natural way possible to minimize the potential influence on interactions between agents as much as possible. Observations have allowed us to systematically identify valuable behaviors by selecting the aspects that we deemed significant. Immersion has allowed us to better understand the context and the mechanisms explaining behaviors. Being close to the data made the discovery of the forces involved possible and allowed us to construct empirically valid statements about the interpretations (Eisenhardt and Graebner, 2007; Yin, 2013). After we selected experts relevant to our aim, we conducted focus groups with them to validate the observation analysis.

All behaviors are regulated by interactions between people that involve an analysis of intersubjective dynamics. Competency therefore depends on the historical, social, and ethical context in which it is situated and depends as much on the individual as it does on the group. So, our second source of data was all the interviews with experts involved in the adoption of Lean. We interviewed the most active internal lean experts to access detailed information on past, present, and planned behaviors in the near future. In addition, other information came to us from employees and managers allowing us to put into perspective more structured, textured, emerging information from these informal conversations. Most of the interviews took the form of a series of open questions; even though we had prepared a list of questions beforehand to make sure we addressed the most relevant topics.

Focus groups shed light on intangible behavioral competencies that experts used. It allowed us to generate richer data than individual interviews, which were effective in capturing the critical interactional dynamics of social practices. Each focus group lasted about two hours. Confidentiality of the data and anonymity of the participants' identities were maintained throughout. A previous analysis, from interviews and observations, was made to spot examples of individual experts' behaviors and intentions that contributed to the adoption of Lean practices. Related to their actions, a preliminary list of competencies was set, then discussed according to the competencies defined by HR representatives. Four focus groups, including the 21 experts, conducted from 2014 to 2017, help refine the list of competencies in a collective approach. Two questions were asked for each competency to refine the list with the experts: whether the competency was relevant for a lean expert, and whether the competency was clearly described. First, experts were invited to point out reasons and suggestions for addressing any disagreements they had in relation to the list. These experts also had to discuss and assess the maturity level of the company departments. A year later (2018), we followed up with the experts' focus group, revising the list of competencies and roles, and twice again in the following years (2019, 2020).

From these focus groups, we combined the data to generate a core competency list and a typology of the roles played by the experts during lean adoption. Identified competencies were analyzed considering the lean competencies found in the literature (cf. Table I). The analysis checked for conceptual and content consistency between the description of the principles and the statement of the competencies. The interpretive validity was assessed through the correlation to lean literature and by confronting the perceived competencies and roles of experts.

5. Findings

5.1 Descriptive findings

Lean adoption at Groupe PSA has taken on various forms, starting from experimental projects to the development of a management system. To distinguish the maturity level between the three studied departments, we used Eraut's (1994) classification system based on the internal audit system evaluation results. The Manufacturing department could be considered proficient because its members achieved an autonomous execution of the PSA Excellence System. The R&D department could be considered an advanced beginner because of its rigorous training, but only partial application and execution of lean methods were implemented. Finally, the S&M department

could be seen as a “newcomer” due to the low number of employees who were participating in the PSA Excellence System. These departments’ dedication to lean adoption was the foundation upon which we built our differentiation criteria. Peculiarities of change types and lean experts’ interventions at Groupe PSA called for a need to focus on the role of lean experts.

In PSA’s Manufacturing department, the decision to adopt lean was made in 2000 when an international survey showed that the company was far from achieving the same levels of success as its competitors. However, some traces of lean adoption were found before 2000, such as Just-in-time and Quality Circles. A jump in adoption happened in 2002 when a partnership was formed with Toyota, giving Groupe PSA open access to the features of its production system. Groupe PSA employees were sent to their new partner’s company to learn from its operating Toyota Production System. They were then expected to report back to their colleagues and implement what they learned and observed. These employees became the first internal lean experts and henceforth, acted in a more normative way than the others. They implemented several technical practices, as well as management practices such as management control and policy deployment. As more and more employees became convinced by observations and exemplarity of the benefits, these experts’ roles transformed from mere implementers to technical specialists and the safeguards of lean appropriation. This role change was demonstrated by assessment activities and roadmap definitions, as the lean experts’ network grows.

In the R&D department, lean adoption began in 2002 when the partnership between the Groupe PSA and Toyota was confirmed. Some engineers went to work with Toyota to better understand the way they approached to design and product conception and how the two were linked to production. They were trained by Toyota coordinators during the new plant’s design, and they brought back their know-how and new competencies to transfer to their company. Most of their actions revolved around training and guidance in lean products and process development. Sometimes, they conducted surveys assessing the adoption maturity and adherence of employees to decide which areas needed improvement. These engineers became the lean experts of the R&D department. They were mainly instructors and facilitators, meaning that the change mainly came from employees’ needs. They assisted managers in their transformational projects.

In the S&M department, lean adoption officially began in 2007 with the goal in mind to transfer lean practices to departments other than Manufacturing. A small team of lean experts was created.

Some experts worked alongside the sales representative network to improve the way they operate activities. Other lean experts assisted department managers in their daily operations. Lean experts focused mainly on visual management and standardized work as the entryway to lean practices. These experts essentially acted as coaches or change agents in that they understood the current situation of their recipients and diagnosed if lean practices can help them solve their daily problems and make changes according to this diagnosis and the willingness of the person concerned. They were the ones mainly using behavioral competencies to transfer lean practices. Even still, these experts struggled to engage more and more employees to embrace lean practices daily. The Quality Management System (QMS), already in place before 2007, was what employees accepted most as opposed to lean.

5.2 Analysis

After setting up the context of the case study, observations, immersions, and focus groups allowed us to depict a general view of competencies related to lean practices through the lens of lean experts' practices.

The first set of lean competencies is associated with operational efficiency: these are the technical competencies commonly found in the present literature (Negrão et al., 2017; Womack et al., 1990). The second set of lean competencies pertains to organizational efficiency: these are the behavioral competencies that experts possess and use to support routinized learning. The latter are closely associated with Liker and Trachilis' (2015) framework. The last set of lean competencies refers to relational efficiency: these are the behavioral competencies that outline the steps towards building capabilities. This capability-building process was constructed as a combination of problem resolution from an individual perspective, human resource development from a group perspective, and systemic interactions from a system perspective. These three sets of lean competencies that we found during this study can be related to the following competencies emphasized in the literature pertaining to TPS experts (Fujimoto, 1999): routinized executing competencies, routinized learning competencies, and evolutionary learning competencies. Our results could provide a clearer understanding of evolutionary learning competencies which were defined as (1) problem resolution, (2) human resources development, and (3) systemic interactions. These behavioral competencies could be related to the competencies that foster innovative capabilities of the

organization and finally participate in the success of the adoption (Liker and Trachilis, 2015; Maalouf and Gammelgaard, 2016).

The results show a gap between the prescribed competencies, i.e., those defined by HR employees, and the described competencies, those held by lean experts resulting from the case analysis. This gap highlights two elements: the adaptability of the experts and the misconception of the competencies needed by the organization according to maturity levels. These results emphasize, at a low level of maturity, a strong need for upstream exploration and coaching to refine needs collectively. This explains the emergence of these behavioral competencies pertaining to relational efficiency. The study also shows that lean experts displaying behavioral competencies intervene in less mature environments and that lean experts displaying technical competencies intervene in more mature environments. For intermediate maturity environments, lean experts make a considerable effort to gradually transfer competencies to employees during the beginning stages of adoption, returning only when specific needs arise. This brings out the notion of temporality in the transfer of lean competencies to employees. The following Table III gathers the general agreement about lean competencies:

Table III. Description of lean competencies defined during the research.

Please insert Table III

During the interviews, a clear dichotomy surfaced between institutional experts, sometimes self-proclaimed, and emergent experts, recognized as experts by peers. A correlation may exist between the institutional expert and their assertive interventions. Interestingly, emergent experts in the S&M department seem to have a greater impact on how employees perceive lean and its adoption. These experts' interventions oscillate between push and pull tactics depending on the environment in which they intervene. We were told that they act in a coaching manner when interacting with a manager: *"We do not want to go beyond what managers want to see accomplished within their department. Once we understand what managers want, with their help, we can carefully analyze their interactions with other employees and their work environment. When possible, we help managers map out steps towards achieving their goals so that they have a positive impact on their interactions with employees and the work environment."* (PES Manager at S&M department, Personal interview in French, September 2016). They are often recognized as coaches because they only use their expertise to help managers find harmony between what they want to do in their

environment and what they are allowed to do. They push the manager towards a more realistic observation of his/her own behaviors by asking key questions rather than giving advice or training. In turn, their behavioral competencies help transfer the appropriate technical practices which can then be adapted to the environment of the manager. In this case, these experts appear at a low maturity level to follow the agents' pace of appropriation and, accordingly, protect the adoption from deviation. They possess a high and extensive level of expertise including behavioral and technical competencies.

At an average maturity level, experts support the employees' development and transfer their knowledge in a Just-In-Time manner – the knowledge necessary at the right time and in the right amount for the receiver. Their actions attempt to bring about adoption initiatives while canalizing efforts of appropriation. These experts act as facilitators or instructors, encouraging alignment of individual practices around a collective dynamic of improvement. They possess a medium level of expertise, especially regarding technical competencies. Finally, when employees reach high maturity levels, lean experts bring their own technical expertise in a way that develops their employees and gives some insight into how to run the system and keep it from deviating. *“Beyond reinforcing organizational alignment, their interventions provide individual expertise acquisition for employees”* (PES Manager at Manufacturing department, Personal interview in French, December 2017). By transferring their knowledge and challenging employees, they themselves also improve. These mentors oversee and ensure that the rigorous performance of lean practices by employees is aligned with lean methodology, while also respecting the fact that employees are the experts in their own work. They often provide insight and new perspectives that expand employees' understanding of the practices and often give pointed feedback. In comparison with coaches that tend to focus more on generic issues, these mentors look at more targeted, job-specific issues. To do so, they possess a specific but highly narrow level of expertise in technical competencies. When they are confronted with difficulties, they call on *“magicians”* who *“possess softer competencies”* (PES Manager at Manufacturing department, Personal interview in French, July 2016) and who can more effectively transfer lean in more sensitive environments.

At times, we sensed a strong opposition between PES managers and Quality/Six Sigma representatives even though both were responsible for process quality. In some departments, both were engaged in a sort of rivalry over territory and had conflicting and opposing priorities. For instance, the following account summarizes the discrepancy that exists between Quality or Six

Sigma experts and Lean experts: *"Quality provides an old-school approach based on top-down procedures and rigid maturity grids. It is time-consuming and far less efficient than PDCA."* (PES Manager at R&D department, Personal interview in French, November 2014). *"Six sigma experts are anti-lean because they do not implement long-term viable solutions. Six Sigma is a segmentation of tasks between the expert and operators. We, lean experts, support operators to let them improve the process. Operators are the experts! Six Sigma is the worst expression of Taylorism."* (PES Manager at Manufacturing department, Personal interview in French, May 2014). Moreover, the Quality department, which had its own internal issues keeping them from being recognized by other departments, felt that the PES interfered with its activities. In the S&M department, for instance, Quality rejected the lean activities prepared and performed by lean experts. On the contrary, in the Manufacturing department, because of its long history of working with lean, Quality was introduced jointly with the PES to stabilize the system already in place.

The results presented in this section provide a list of lean competencies and show how a lean expert's role changes depending on the maturity level of the environment in which they intervene. We found that experts put a strong emphasis on behavioral competencies when working in lower maturity level environments. As employees began to adopt and apply behavioral competencies in their day-to-day tasks, a sign of improved maturity levels, experts were then able to start gradually shifting their focus towards the transference of their technical competencies. However, when we compared this lean expert approach to that of Six Sigma or Quality representatives, we found several differences worth considering, namely when and how behavioral competencies were used throughout the adoption process.

6. Discussion

This exploratory study illustrates the behavioral dimension (Wieland et al., 2016) through existing interactions between lean experts and other employees (Schorsch et al., 2017). To gain insight into lean experts' interactional competencies, we studied their activities and transference of practices (Ellinger and Ellinger, 2014). Lean experts influenced the creation of emerging practices related to process improvement and competencies development in their organization. Drawing from their practices, we have compiled a list of competencies and have compared them to the experts' perceptions. Identification of their competencies allowed us to characterize their roles in relation to the department in which they intervened. We defined expert competencies as specific,

observable, verbal, or non-verbal actions coming from experts interacting directly with employees in a defined organizational configuration.

The role of lean experts evolves dynamically depending on the phase of lean adoption and, indirectly, because of managerial feedback (dominant and local perceptions). Lean experts' roles can be summarized as follows: at a low level of maturity, they act as coaches. At an average level of maturity, they act as facilitators or instructors. At a high level of maturity, they act as mentors. The level of lean behavioral competencies appears to be inversely related to the adoption phase. This phenomenon can be explained by the dissemination of expertise throughout the organization and the transference of responsibility to employees, local managers, and directors. This knowledge transfer provides an avenue for a deeper dive into the technical expertise associated with lean provided by experts (Danese et al., 2017; Tortorella et al., 2018). One role emerged from the study—the role of sensei: the integrator—which is taken on by the most qualified lean experts. The integrator role consists of two parts: the “critical observer” and the “reflective learner”. It unlocks the potential of other roles by reinforcing their interrelatedness while making use of their distinctive features (Vilkinas and Cartan, 2001). However, the integrator role of the sensei, which is not a universal role, is supposed to give them the possibility of adaptation in any circumstance. Their adaptability is dependent upon the environment in which he intervenes and whether the dominant lean practices are already established. As the safeguards of lean expertise, lean experts serve as the catalysts in a successful lean adoption, passing on the responsibility to local managers and directors.

The numerous articles dealing with lean practices, that do not come to a mutual understanding of those practices, proves the need for contextual appropriation. The study depicts the evolution of experts' roles through their dominant practices and competencies related to the adoption phase (see Fig. II): all practices are not equal in terms of expected outcomes, and they require both technical and behavioral competencies. The behavioral competencies presented in research are generally considered secondary compared to the technical competencies (Kregel et al., 2019). Behavioral competencies seem to be more human related to incite employee engagement. We identified a conflict between taking the time to incite employee engagement through behavioral competencies and wanting to show quick results by using technical competencies. Managers and directors are considered key factors during the adoption process. However, this study shows that if lean experts

have a stronger and more narrow influence during the adoption process, managers could have a larger impact.

Research typically addresses the topic of context during lean adoption as a general or global company context whereas our research demonstrates that specifying the context (i.e. department vs. organization) helps a richer understanding of the adoption process. This aligns with Secchi and Camuffo's (2019) research about the conditions for lean success established during the adoption process and organizational configuration. The environment context and maturity (i.e. employees' and managers' willingness to adopt new practices) seem to be significant aspects to take into account before developing more specific practices, such as Hoshin Kanri (Tortorella et al., 2018). Some issues concerning the positioning of experts arose. There remains a clear dissonance between agents and experts, between those who work and those who improve (Alves et al., 2012; Secchi and Camuffo, 2019). We notice that, in more advanced parts of the organization, there is no segmentation between work and improvement, such as actions and learning, nor is there an explicit designation of experts and non-experts. The job-related background of the experts, in addition to their own lean competencies, could help to clarify the perceived legitimacy of lean experts.

7. Implications, limitations, and future research

7.1 Theoretical & practical implications

Through this exploratory approach, this article fulfilled the following two objectives: (1) to clarify lean behavioral competencies and (2) to depict the role of lean experts in the transfer of these lean practices. Our findings provide a means for lean experts or HR professionals to consciously select and learn competencies and behavioral roles that contribute to lean adoption. Interactional competencies were found to cut across one or more lean principles, suggesting that experts who display these competencies can influence multiple lean principles simultaneously. Although interactional practices are recognized in the lean literature as an essential part of lean (Shah and Ward, 2007), attempts to adopt lean often result in technical practices without sufficient attention paid to its interactional practices. Our results show that these interactional practices are integrated into the organization through the specific roles of experts. However, what really differentiates a successful lean adoption is the greater use of interactional practices related to behavioral competencies by all agents in the organization (Bortolotti et al., 2015). The overview allows the researcher or lean experts to make use of the lean behavioral competencies in combination with the

desired effect regarding the adoption of lean practices. This first analysis of lean behavioral competencies and experts' roles provides opportunities for revisiting lean theory. Although the view of lean as a socio-technical system is prevalent in the literature, the study reinforces the change in how employees interact with each other and provides insight into how lean experts interact with employees and managers.

The main contribution of this study is the dynamic role played by experts, varying according to their level of expertise, employees' perception of lean, and the maturity levels of the environment in which they intervene. This finding is consistent with Tortorella et al.'s (2018) and Bianco et al.'s (2021) finding that the evolutionary lean adoption process requires different leadership styles related to the maturity levels of the organization. Lean experts influence the creation of emerging human relationships that are beneficial to process improvement and competencies development. Generally, lean experts have a positive impact on the adoption process, but our study shows that sometimes they can have a negative impact if their role does not benefit the environment and the employees involved. Their legitimacy, their range of competencies, their social interactions, and their history within the company and with their colleagues also influence the relationship between their roles and the adoption process. The main theoretical implication is that the study sheds light on one of the major reasons for the failure of lean adoption: researchers and practitioners studying or adopting lean emphasize more on the technical aspects, whereas the relational aspects can provide more leverage and acceptance for adoption.

Figure I. Evolution of lean experts' competencies related to the organization's maturity levels.

Please insert Figure I

In terms of practical implications, the study contributes to the definition of the roles of lean practitioners and the related actions taken during implementation. The qualitative relationships presented in Figure I could help them better understand which role they need to take depending on the environment or situation in which they intervene. The study provides a clarification of all the competencies that need to be developed to achieve lean expertise. By confronting the competencies

found in the literature with those confirmed by the case study, we discover more detailed competencies, especially those related to relational efficiency.

7.2 Limitations and future research

This specific case study contributes to lean theories by building concrete, context-dependent knowledge (Ridder, 2017), i.e. the impact of lean experts, their competencies, and their roles on the adoption process. Our study has some limitations regarding the methodology used and the results. One limitation was our degree of distance from the field research. It is essential for the researcher to avoid biased data by being too close to the agents and experts on the field. This may lead to an overestimation of the significance of the data due to the closeness that developed between the researcher and the agents. In terms of findings, this study is limited to a single case, and unfortunately, research on the role of lean experts in lean adoption is still in its infancy. The strength of our study is the richness of the data collected and the length of the empirical validation. However, a broader and higher sample of companies would provide more confidence in the analysis and help generalize the results. Cross-organizational or quantitative studies, including different industries and countries, on the interaction between experts and employees during lean adoption would complement our findings. The single case study was also from a large organization. In small and medium-sized organizations, the role of experts is embodied by mid-level managers. Focusing on these mid-level managers can provide more nuance and help to appreciate the new interactions in a lean organization (Fannon et al., 2021). It could help assess the network of influence between all agents in the organization.

During the study, it was challenging to disentangle the rhetoric and actions of the experts' approaches to lean adoption. The application of lean practices occurred in a dispersed and fragmented manner, sometimes pushed by managerial injunctions. Separating these practices from the organizational context and thus recognizing lean practices or competencies as distinct entities, could hide organizational mechanisms influencing lean adoption (Gelei et al., 2015; Tortorella et al., 2018). To consider the context of actions and balance the potentially subjective aspects of the data collection method, a reflexive approach can be used to analyze the changes in the expert's role over time (i.e., a reflective diary for each expert). In addition, the systemic interactions between competencies may be a research avenue that clarifies the relationship and influence between them and their associated practices. For example, Bianco et al. (2021) were able to structure

competencies in a model with 5 hierarchical levels, which helped prioritize which set of competencies to develop first. Specifying the influence of the temporality of the application of lean practices, regarding the contextual factors, could be considered an important research avenue to discuss the related organizational performance. Therefore, we recommend that researchers better acknowledge the influence of lean interactional practices and behavioral competencies during lean implementation and how they relate to technical practices, technical competencies, contextual factors, and organizational performance.

8. Conclusion

Conducting this research, we developed a list of lean behavioral competencies to unveil the lean practices which helped us to define internal lean experts' typologies in a company context. The results show that they used precise behavioral competencies to transfer their practices. After transferring lean practices through specific interventions related to an operational context, the lean experts gradually withdrew and let employees complete the adoption. This research was based on a single case study and therefore requires additional studies, including ones on small and medium organizations, and ones on different industry sectors, to generalize the results. To deepen the results, new research can illustrate the temporality and context of lean experts' actions studied and their network of influence. Organizations use lean experts as safeguards of lean expertise or catalysts to embrace the lean system in its entirety. This study shows that lean experts' roles during the lean transformation are highly influential in the adoption's success. Thus, their technical and behavioral competencies, related to the maturity level of the environment in which they intervene, appear to be a determining factor in the way they will perform transference practices.

Acknowledgment:

We would like to thank the reviewers for their insightful comments, which helped to significantly improve the first manuscript. We are grateful for the support we received from all the lean experts at the PSA Group and from all the employees who helped us with our research project.

References:

Aij, K.H., Teunissen, M., 2017. Lean leadership attributes: a systematic review of the literature. *Journal of Health Organization and Management* 31, 713–729. <https://doi.org/10.1108/JHOM-12-2016-0245>

- Alves, A.C., Dinis-Carvalho, J., Sousa, R.M., 2012. Lean production as promoter of thinkers to achieve companies' agility. *Learning Organization* 19, 219–237. <https://doi.org/10.1108/09696471211219930>
- Antony, J., Karaminas, H., 2016. Critical assessment on the Six Sigma Black Belt roles/responsibilities, skills and training: A global empirical study. *International Journal of Quality & Reliability Management* 33, 558–573. <https://doi.org/10.1108/IJQRM-08-2014-0106>
- Antony, J., Snee, R., Hoerl, R., 2017. Lean Six Sigma: yesterday, today and tomorrow. *International Journal of Quality & Reliability Management* 34, 1073–1093. <https://doi.org/10.1108/IJQRM-03-2016-0035>
- Ballé, M., 2016. *Lead with Lean: On Lean Leadership and Practice*, 1st ed. CreateSpace Independent Publishing Platform.
- Battilana, J., 2010. The Enabling Role of Social Position in Diverging from the Institutional Status Quo: Evidence from the UK National Health Service. *Organization Science* 22, 817–834. <https://doi.org/10.1287/orsc.1100.0574>
- Battilana, J., Casciaro, T., 2012. Change Agents, Networks, and Institutions: A Contingency Theory of Organizational Change. *Academy of Management Journal* 55, 381–398. <https://doi.org/10.5465/amj.2009.0891>
- Beauvallet, G., Houy, T., 2010. Research on HRM and lean management: a literature survey. *International Journal of Human Resources Development & Management* 10, 14–33.
- Bianco, D., Godinho Filho, M., Osiro, L., Ganga, G.M.D., Tortorella, G.L., 2021. The driving and dependence power between Lean leadership competencies: an integrated ISM/fuzzy MICMAC approach. *Production Planning & Control* 0, 1–25. <https://doi.org/10.1080/09537287.2021.1969047>
- Bortolotti, T., Boscari, S., Danese, P., 2015. Successful lean implementation: Organizational culture and soft lean practices. *International Journal of Production Economics* 160, 182–201. <https://doi.org/10.1016/j.ijpe.2014.10.013>
- Camuffo, A., Gerli, F., 2018. Modeling management behaviors in lean production environments. *International Journal of Operations & Production Management* 38, 403–423. <https://doi.org/10.1108/IJOPM-12-2015-0760>

- Collins, H., Evans, R., 2007. *Rethinking Expertise*. University of Chicago Press, Chicago.
- Cox, J.W., Hassard, J., 2005. Triangulation in Organizational Research: A Re-Presentation. *Organization* 12, 109–133. <https://doi.org/10.1177/1350508405048579>
- Cua, K.O., McKone, K.E., Schroeder, R.G., 2001. Relationships between implementation of TQM, JIT, and TPM and manufacturing performance. *Journal of Operations Management* 19, 675–694. [https://doi.org/10.1016/S0272-6963\(01\)00066-3](https://doi.org/10.1016/S0272-6963(01)00066-3)
- Dabhilkar, M., Åhlström, P., 2013. Converging production models: the STS versus lean production debate revisited. *International Journal of Operations & Production Management* 33, 1019–1039. <https://doi.org/10.1108/IJOPM-08-2012-0316>
- Dahlgaard, J.J., Dahlgaard-Park, S.M., 2006. Lean production, six sigma quality, TQM and company culture. *TQM Magazine* 18, 263–281.
- Danese, P., Romano, P., Boscari, S., 2017. The transfer process of lean practices in multi-plant companies. *International Journal of Operations & Production Management* 37, 468–488. <https://doi.org/10.1108/IJOPM-12-2014-0571>
- Dankbaar, B., 1997. Lean Production: Denial, Confirmation or Extension of Sociotechnical Systems Design? *Human Relations* 50, 567–584.
- Drucker, P.F., 1959. *Landmarks of tomorrow*, 1st edition. ed. Harper.
- Eisenhardt, K.M., Graebner, M.E., 2007. Theory Building From Cases: Opportunities And Challenges. *Academy of Management Journal* 50, 25–32. <https://doi.org/10.5465/AMJ.2007.24160888>
- Ellinger, A.E., Ellinger, A.D., 2014. Leveraging human resource development expertise to improve supply chain managers ' skills and competencies. *European Journal of Training and Development* 38, 118–135. <https://doi.org/10.1108/EJTD-09-2013-0093>
- Emiliani, M.L., 2003. Linking leaders' beliefs to their behaviors and competencies. *Management Decision* 41, 893–910. <https://doi.org/10.1108/00251740310497430>
- Emiliani, M.L., Stec, D.J., 2005. Leaders lost in transformation. *Leadership & Organization Development Journal* 26, 370–387. <https://doi.org/10.1108/01437730510607862>
- Eraut, M., 1994. *Developing Professional Knowledge And Competence*. Routledge, London ;

Washington, D.C.

Fannon, S.R., Munive-Hernandez, J.E., Campean, F., 2021. Mastering continuous improvement (CI): the roles and competences of mid-level management and their impact on the organisation's CI capability. *The TQM Journal* 34, 102–124. <https://doi.org/10.1108/TQM-03-2021-0083>

Flynn, B.B., Sakakibara, S., Schroeder, R.G., 1995. Relationship between JIT and TQM: Practices and Performance. *The Academy of Management Journal* 38, 1325–1360. <https://doi.org/10.2307/256860>

Fujimoto, T., 1999. *Evolution of Manufacturing Systems at Toyota*, 1st edition. ed. Productivity Press, New York.

Gelei, A., Matyusz, Z., Losonci, D., 2015. Lean production and leadership attributes – the case of Hungarian production managers. *Journal of Manufacturing Technology Management* 26, 477–500. <https://doi.org/10.1108/JMTM-05-2013-0059>

Herron, C., Hicks, C., 2008. The transfer of selected lean manufacturing techniques from Japanese automotive manufacturing into general manufacturing (UK) through change agents. *Robotics and Computer-Integrated Manufacturing, ICMR2005: Third International Conference on Manufacturing Research* 24, 524–531. <https://doi.org/10.1016/j.rcim.2007.07.014>

Holmemo, M.D.-Q., Rolfsen, M., Ingvaldsen, J.A., 2018. Lean thinking: outside-in, bottom-up? The paradox of contemporary soft lean and consultant-driven lean implementation. *Total Quality Management & Business Excellence* 29, 148–160. <https://doi.org/10.1080/14783363.2016.1171705>

Johri, A., 2015. Impressions in action: the socially situated construction of expertise in the workplace. *Journal of Organizational Ethnography* 4, 44–63. <https://doi.org/10.1108/JOE-04-2014-0008>

Klag, M., Langley, A., 2013. Approaching the Conceptual Leap in Qualitative Research. *International Journal of Management Reviews* 15, 149–166. <https://doi.org/10.1111/j.1468-2370.2012.00349.x>

Kregel, I., Ogonek, N., Matthies, B., 2019. Competency profiles for lean professionals – an international perspective. *International Journal of Productivity and Performance Management* 68, 423–446. <https://doi.org/10.1108/IJPPM-09-2017-0237>

- Laureani, A., Antony, J., 2011. Standards for Lean Six Sigma certification. *International Journal of Productivity and Performance Management* 61, 110–120. <https://doi.org/10.1108/17410401211188560>
- Lee-Mortimer, A., 2006. A lean route to manufacturing survival. *Assembly Automation* 26, 265–272. <https://doi.org/10.1108/01445150610705155>
- Liker, J., 2004. *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, 1st edition. ed. McGraw-Hill, New York.
- Liker, J., Ballé, M., 2013. Lean Managers Must be Teachers. *Journal of Enterprise Transformation* 3, 16–32. <https://doi.org/10.1080/19488289.2013.784222>
- Liker, J., Hoseus, M., 2008. *Toyota Culture: The Heart and Soul of the Toyota Way*, 1st edition. ed. McGraw-Hill Professional, New York.
- Liker, J., Trachilis, G., 2015. *Developing Lean Leaders at all Levels: A Practical Guide*. Lean Leadership Institute Publications.
- Liu, C., Niu, Z., Li, Q., 2021. Relationship between lean tools and operational and environmental performance by integrated ISM–Bayesian network approach. *The TQM Journal* ahead-of-print. <https://doi.org/10.1108/TQM-11-2020-0260>
- Longoni, A., Pagell, M., Johnston, D., Veltri, A., 2013. When does lean hurt? – an exploration of lean practices and worker health and safety outcomes. *International Journal of Production Research* 51, 3300–3320. <https://doi.org/10.1080/00207543.2013.765072>
- Maalouf, M., Gammelgaard, B., 2016. Managing paradoxical tensions during the implementation of lean capabilities for improvement. *International Journal of Operations & Production Management* 36, 687–709. <https://doi.org/10.1108/IJOPM-10-2014-0471>
- Maginnis, M.A., 2013. The Impact of Standardization and Systematic Problem Solving on Team Member Learning and Its Implications for Developing Sustainable Continuous Improvement Capabilities. *Journal of Enterprise Transformation* 3, 187–210. <https://doi.org/10.1080/19488289.2013.818598>
- Magnani, F., 2016. Historical evolution of a Lean system: case study of the PSA Group. *Logistique & Management* 24, 199–206. <https://doi.org/10.1080/12507970.2016.1269620>

- Mårtensson, A., Snyder, K., Ingelsson, P., 2018. Interlinking Lean and sustainability: how ready are leaders? *The TQM Journal* 31, 136–149. <https://doi.org/10.1108/TQM-04-2018-0046>
- Negrão, L.L.L., Filho, M.G., Marodin, G., 2017. Lean practices and their effect on performance: a literature review. *Production Planning & Control* 28, 33–56. <https://doi.org/10.1080/09537287.2016.1231853>
- Netland, T.H., Ferdows, K., 2014. What to Expect From a Corporate Lean Program. *MIT Sloan Management Review* 55, 83–89.
- Netland, T.H., Powell, D.J., Hines, P., 2019. Demystifying lean leadership. *International Journal of Lean Six Sigma* ahead-of-print. <https://doi.org/10.1108/IJLSS-07-2019-0076>
- Niepcz, W., Molleman, E., 1998. Work design issues in lean production from a sociotechnical systems perspective. *Human relations* 51, 259–287.
- Pettersen, J., 2009. Defining lean production: some conceptual and practical issues. *TQM Journal* 21, 127–142. <https://doi.org/10.1108/17542730910938137>
- Reinhardt, W., Schmidt, B., Sloep, P., Drachsler, H., 2011. Knowledge Worker Roles and Actions—Results of Two Empirical Studies. *Knowledge and Process Management* 18, 150–174. <https://doi.org/10.1002/kpm.378>
- Reke, E., Powell, D., Olivencia, S., Coignet, P., Chartier, N., Ballé, M., 2020. Recapturing the Spirit of Lean: The Role of the Sensei in Developing Lean Leaders. pp. 117–125. https://doi.org/10.1007/978-3-030-41429-0_12
- Ridder, H.-G., 2017. The theory contribution of case study research designs. *Business Research* 10, 281–305. <https://doi.org/10.1007/s40685-017-0045-z>
- Rother, M., 2009. *Toyota Kata: Managing People For Improvement, Adaptiveness, and Superior Results*, 1st edition. ed. McGraw-Hill Professional, New York.
- Salentijn, W., Beijer, S., Antony, J., 2021. Exploring the dark side of Lean: a systematic review of the lean factors that influence social outcomes. *The TQM Journal* 33, 1469–1483. <https://doi.org/10.1108/TQM-09-2020-0218>
- Saxby, R., Cano-Kourouklis, M., Viza, E., 2020. An initial assessment of Lean Management methods for Industry 4.0. *The TQM Journal* 32, 587–601. <https://doi.org/10.1108/TQM-12-2019->

Schorsch, T., Wallenburg, C.M., Wieland, A., 2017. The human factor in SCM: Introducing a meta-theory of behavioral supply chain management. *International Journal of Physical Distribution & Logistics Management* 47, 238–262. <https://doi.org/10.1108/IJPDLM-10-2015-0268>

Secchi, R., Camuffo, A., 2019. Lean implementation failures: The role of organizational ambidexterity. *International Journal of Production Economics* 210, 145–154. <https://doi.org/10.1016/j.ijpe.2019.01.007>

Seidel, A., Saurin, T.A., Marodin, G.A., Ribeiro, J.L.D., 2017. Lean leadership competencies: a multi-method study. *Management Decision* 55, 2163–2180. <https://doi.org/10.1108/MD-01-2017-0045>

Shah, R., Ward, P.T., 2007. Defining and developing measures of lean production. *Journal of Operations Management* 25, 785–805. <https://doi.org/10.1016/j.jom.2007.01.019>

Shah, R., Ward, P.T., 2003. Lean manufacturing: context, practice bundles, and performance. *Journal of Operations Management* 21, 129–149.

Stake, D.R.E., 1995. *The Art of Case Study Research*. SAGE Publications, Inc, Thousand Oaks.

Toledo, J.C., Gonzalez, R.V.D., Lizarelli, F.L., Pelegrino, R.A., 2019. Lean production system development through leadership practices. *Management Decision* 57, 1184–1203. <https://doi.org/10.1108/MD-08-2017-0748>

Tortorella, G.L., de Castro Fettermann, D., Frank, A., Marodin, G., 2018. Lean manufacturing implementation: leadership styles and contextual variables. *Int Jnl of Op & Prod Mngemnt* 38, 1205–1227. <https://doi.org/10.1108/IJOPM-08-2016-0453>

Tortorella, G.L., Fettermann, D., Anzanello, M., Sawhney, R., 2017a. Lean manufacturing implementation, context and behaviors of multi-level leadership: A mixed-methods exploratory research. *Journal of Manufacturing Technology Management* 28, 867–891. <https://doi.org/10.1108/JMTM-06-2017-0128>

Tortorella, G.L., Miorando, R., Tlapa, D., 2017b. Implementation of lean supply chain: an empirical research on the effect of context. *The TQM Journal* 29, 610–623. <https://doi.org/10.1108/TQM-11-2016-0102>

- Van Dun, D.H., Hicks, J., Wilderom, C., 2017. Values and behaviors of effective lean managers: Mixed-methods exploratory research. *European Management Journal* 35, 174–186. <https://doi.org/10.1016/j.emj.2016.05.001>
- Vilkinas, T., Cartan, G., 2001. The behavioural control room for managers: the integrator role. *Leadership & Organization Development Journal* 22, 175–185. <https://doi.org/10.1108/01437730110395079>
- Vinodh, S., Antony, J., Agrawal, R., Douglas, J.A., 2020. Integration of continuous improvement strategies with Industry 4.0: a systematic review and agenda for further research. *The TQM Journal* 33, 441–472. <https://doi.org/10.1108/TQM-07-2020-0157>
- Warhurst, R., 2013. Hard times for HRD, lean times for learning? Workplace participatory practices as enablers of learning. *European Journal of Training & Development* 37, 508–526.
- Weick, K.E., Quinn, R.E., 1999. Organizational Change and Development. *Annual Review of Psychology* 50, 361–386. <https://doi.org/10.1146/annurev.psych.50.1.361>
- Wieland, A., Handfield, R.B., Durach, C.F., 2016. Mapping the Landscape of Future Research Themes in Supply Chain Management. *Journal of Business Logistics* 37, 205–212. <https://doi.org/10.1111/jbl.12131>
- Womack, J.P., Jones, D.T., Roos, D., 1990. *The Machine That Changed the World: The Story of Lean Production*, Reprint edition (2000). ed. Free Press, New York.
- Yin, R.K., 2013. *Case Study Research: Design and Methods*, Fifth Edition edition. ed. SAGE Publications, Inc, Los Angeles.

Table 1. Lean practices and associated lean competencies found in literature

Lean practices	Lean competencies	Main Authors
Policy deployment / Long-term vision	Hoshin Kanri, Management Control, Commitment	a ; b ; f ; g ; h ; j ; n ; q ; t ; w ; x ; y
Just-In-Time	Continuous flow, Kanban, VSM	e ; g ; i ; k ; p ; r ; u ; v ; w
Total Quality Management (Jidoka)	Autonomation, Quality assurance, Process quality planning	b ; e ; g ; h ; i ; k ; p ; r ; u ; v
Total Productive Maintenance	Auto-maintenance, 5S	e ; g ; p ; r ; u ; v
Supplier relationship improvement	Supplier involvement in decision-making, Cooperation	b ; c ; e ; g ; i ; k ; p ; u ; v
Customer relationship improvement	Create value for customer, Respond to customer demand	c ; e ; f ; h ; i ; p ; u ; v ; y
Nominal management	Performance evaluation, Goals alignment, Process stabilization	b ; d ; g ; j ; k ; o ; q ; r ; t ; w ; y
Improvement management	Supportiveness, Sense of challenge, Daily Kaizen	c ; d ; h ; i ; k ; m ; o ; p ; q ; r ; t ; w ; x ; y
Gemba focus (Value & 3M)	Visual Management development, Go and See	a ; b ; f ; g ; q ; r ; t ; y
Problem resolution	Problem-solving methods (PDCA, TBP, 8D)	b ; c ; f ; h ; i ; k ; p ; q ; r ; s ; t
Standard development	Standardized work, Best practices acceptance, Organizational learning	d ; f ; g ; h ; r ; s
Respect for people (HRM practices)	Empowerment, Trust development, Recognition	a ; b ; d ; h ; k ; m ; n ; p ; t ; u ; v ; w ; x
Competencies development	Coaching, Training, Self-development	a ; b ; c ; d ; e ; f ; h ; i ; m ; o ; q ; t ; w ; x
Versatility management	Openness, Humility, Leadership, Open Communication	a ; b ; d ; f ; g ; h ; j ; k ; l ; o ; t ; w ; x
Culture development	Organizational focus and alignment, Discipline, Teamwork	a ; b ; d ; f ; g ; h ; m ; n ; t ; y

(a) Aij and Teunissen, 2017; (b) Bianco et al., 2021; (c) Bortolotti et al., 2015; (d) Camuffo and Gerli, 2018; (e) Cua et al., 2001; (f) Emiliani, 2003; (g) Emiliani and Stec, 2005; (h) Fannon et al., 2021; (i) Flynn et al., 1995; (j) Gelei et al., 2015; (k) Kregel et al., 2019; (l) Liker, 2004; (m) Liker and Ballé, 2013; (n) Liker and Hoseus, 2008; (o) Liker and Trachilis, 2015; (p) Negrão et al., 2017; (q) Netland et al., 2019; (r) Netland and Ferdows, 2014; (s) Rother, 2009; (t) Seidel et al., 2017; (u) Shah and Ward, 2007 ; (v) Shah and Ward, 2003; (w) Toledo et al., 2019; (x) Van Dun et al., 2017; (y) Womack et al., 1990)

Table 2. Lean experts' roles definition presented in literature

Role denomination	References
Change agent : promote and enable lean practices adoption through all members of the organization	Antony and Karaminas (2016); Lee-Mortimer (2006); Tortorella et al. (2017)
Coach : intervene with no intention to solve interactional issues related to lean adoption	Antony and Karaminas (2016); Kregel et al. (2019); Lee-Mortimer (2006); Tortorella et al. (2017)
Facilitator : facilitate learnings through employee participation and involvement in lean practices adoption	Maalouf and Gammelgaard (2016); Toledo et al. (2019); Tortorella et al. (2017)
Mentor/Instructor : transfer their lean competencies to others employees	Antony and Karaminas (2016); Kregel et al. (2019); Lee-Mortimer (2006); Liker and Ballé (2013); Tortorella et al. (2017)
Team leader : work with team members in achieving their daily objectives and support improvement efforts	Antony et al. (2017); Antony and Karaminas (2016); Lee-Mortimer (2006)
Technical expert : detain lean competencies and use them to solve technical problems	Antony et al. (2017); Antony and Karaminas (2016); Laureani and Antony (2011)

Table 3. Description of lean competencies defined during focus groups

	Lean Competencies	Lean Practices	Prescribed	Described	Gap	Required
Operational efficiency	Just-in-time	Pull system (Continuous Flow, Kanban, VSM...)	7,6%	4,8%	-2,9%	6,2%
	Jidoka	Auto-quality, Quality gate	9,0%	7,6%	-1,4%	8,3%
	Total Productive Maintenance	Auto-maintenance, 5S	4,8%	4,8%	0,0%	4,8%
	Standard development	Standardized work & Kaizen, Training Within Industry	7,6%	7,6%	0,0%	7,6%
	Gemba Focus	Visual management, Value & abnormality identification	10,0%	9,0%	-1,0%	9,5%
Organizational efficiency	Nominal management	Performance facilitation & review	9,0%	4,8%	-4,3%	6,9%
		Process stabilization	0,0%	2,9%	2,9%	1,4%
	Improvement management	Customer orientation	7,6%	2,9%	-4,8%	5,2%
		Daily Kaizen	9,0%	7,6%	-1,4%	8,3%
		Policy Deployment (Hoshin Kanri)	4,8%	4,8%	0,0%	4,8%
	Respect for people (HRM)	Vision & Goals alignment	1,0%	1,0%	0,0%	1,0%
		Empowerment	0,0%	1,0%	1,0%	0,5%
		Teamwork	7,1%	5,7%	-1,4%	6,4%
		Supportive leadership	0,0%	1,4%	1,4%	0,7%
Relational efficiency	Problem resolution (PDCA)	Planning & Organizing	5,2%	4,3%	-1,0%	4,8%
		Problem identification & observation	0,0%	1,4%	1,4%	0,7%
		Information gathering & problem Analysis	2,9%	2,9%	0,0%	2,9%
		Problem-Solving	4,3%	2,9%	-1,4%	3,6%
		Situation awareness & Decision-Making	2,4%	5,7%	3,3%	4,0%
		Active communication & Influence	0,0%	5,2%	5,2%	2,6%
	Human Resource Development	Motivational Fit Pattern	1,0%	1,0%	0,0%	1,0%
		Self-development	1,0%	2,4%	1,4%	1,7%
		Sense of initiative, Perseverance, Accountability	2,4%	1,0%	-1,4%	1,7%
		On-the-job development	1,0%	1,0%	0,0%	1,0%
	Systemic interactions	Understanding self & others	0,0%	2,4%	2,4%	1,2%
		Coaching & Katas	1,4%	1,4%	0,0%	1,4%
		Versatility	1,0%	1,4%	0,5%	1,2%
		System thinking	0,0%	1,4%	1,4%	0,7%

Fig. I. Evolution of lean experts' competencies related to the organization's maturity levels

