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‘Lean on me’: an integrative literature review on the middle management role in lean

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Abstract

Leadership makes or breaks a lean transformation while mismanagement at the middle management level is likely to impede lean sustainability in particular. Although the role of leadership is widely acknowledged in lean, the middle management role remains fragmented in the literature with a limited focus to date. Taking this into account, the purpose of this paper is to gain a holistic view of the middle management role in lean and its influence on organisational transformation. An integrated literature review methodology was adopted to develop an integrated, conceptual model of the middle management role in lean. The results demonstrate that middle managers are protagonists in lean evolution and indispensable for sustainable success. In acting as cultural change agents, middle managers promote continuous improvement and conduce the transition towards a lean organisation through managerial push and soft lean evolvement, shaping and maintaining a CI-orientated culture by engaging, inspiring and enthusing the wider workforce. The integrative literature review contributes with a six-point integrative, conceptual model of the middle management role in lean, including policy deployment, leader standard work, continuous improvement promotion, self-development, coaching and gemba walks.

Keywords: lean; lean sustainability; lean leadership; middle management; continuous improvement; integrative literature review

1. Introduction

In order to remain competitive, many organisations seek to become “lean”. In doing so, they attempt to reduce or to eliminate different types of waste in their business processes (Jasti & Kodali, 2015) through the development of a continuous improvement (CI) culture (Jørgensen et al., 2007; Mann, 2014).

In retrospect, lean has evolved from a tool-focused approach to a holistic management system, in which soft lean practices, addressing the human factor (e.g. training, employee empowerment and employee involvement), have recently gained more attention. Having a mere focus on its tools and techniques (e.g. VSM and 5S) is associated with limited success (Hadid & Mansouri, 2014; Bortolotti et al., 2015; Hadid et al., 2016). At the same time, a lack of attention to those soft aspects is often argued to undermine lean sustainability (Liker, 2004; Liker & Rother, 2011) whereas paying attention to soft lean practices promotes change towards a lean-thinking CI culture (Martínez-Jurado et al., 2013; Martínez-Jurado & Moyano-Fuentes, 2014).

New ways of management and leadership are required to attain a CI culture (Liker, 2004; Mann, 2005; Hines et al., 2008; Poksinska et al., 2013). It stands to reason that one of the primary causes for lean failure is leaders’ inability to adapt their own behaviour (Mann, 2005; Poksinska et al., 2013) and to have long-term commitment to embed a CI culture in the organisation (Boyle et al., 2011; Liker & Convis, 2011; Holweg et al., 2018; Lins et al., 2019; Tortorella et al., 2019). In their study, Poksinska et al. (2013) aim at contributing to a better understanding of managerial practices and leadership in lean organisations. Their findings describe how managers act as “culture carriers” (p. 896) and

“confirm that lean leadership is a central aspect in implementing and sustaining a lean improvement programme”, concluding that “[w]ithout continuous effort from managers, the lean transformation could not be achieved” (p. 896).

Similarly, Lameijer et al. (2020) describe how leadership is necessary to maintain the organisational motivation and support for implementing lean. In fact, Holweg et al. (2018) found in their longitudinal study of 204 improvement projects that a lack of leadership led to half of the projects sliding back after a year while, after two years, even two-thirds were not sustained. Accordingly, Found et al. (2009) conclude that lean leadership “can either ‘make or break’ a transition towards lean and its sustainability” (p. 2). This statement also finds support from other researchers in the field (Emiliani, 2003; Lucey et al., 2005; Found, 2006; Found & Harvey, 2007; Liker & Convis, 2011; Holweg et al., 2018).

The nature of leadership, however, varies at different hierarchical levels (Lodgaard et al., 2016; Holweg et al., 2018; Netland et al., 2019) and so do roles and responsibilities (Netland et al., 2019). Likewise, levels of influence to initiate, manage and sustain change within the organisation vary (Sohal & Egglestone, 1994; Huy, 2002; Oakland, 2011). It is widely accepted in the academic literature that middle management constitutes a vital link between the strategic and the operational level (Nonaka, 1988; Westley, 1990; Floyd & Wooldridge, 1996; 1997; Engle et al. 2017). Nevertheless, at the same time, middle managers’ efforts remained widely unrecognised by many senior managers and omitted from the focus despite making significant contributions to initiate organisational change (O’Meara & Centers, 1999; Huy, 2001). In particular, middle managers have a strong influence on initiating change as they can influence the mindset and thinking of many subordinates they supervise (O’Meara & Centers, 1999), for instance, by promoting and disseminating a CI culture and by participating in associated, CI-related activities (Prado-Prado et al., 2020). They have also access to cross-functional networks across all managerial levels (Huy, 2001; Bamford & Forrester, 2003) and are more aware of the mutual dependencies within a system. In any case, middle management is usually extensively involved in CI implementation (Lam, 1996) because most CI-related activities simply take place at the middle management level and below (Prado-Prado et al., 2020).

Accordingly, mismanagement at the middle management level is very likely to impede lean sustainability. It is even argued that the function of middle management has a substantial impact on the extent to which organisations succeed in effecting their strategic direction (Anand, 1996; Harrington & Williams, 2004).

In 2004, for instance, a survey by the Lean Enterprise Institute Inc. reported that 21% of lean transformation challenges refer to middle management resistance (Emiliani & Stec, 2005). These results align with others perceiving middle management as a significant source of resistance to CI (Anand, 1996; Endres, 2000; Harrington & Williams, 2004). Despite acknowledging that “an implementation of lean without middle managers is a threat to successful outcomes” (Holmemo & Ingvaldsen, 2016, p. 1342), Holmemo and Ingvaldsen (2016) deduced from their study in Norwegian public sector organisations “that lack of support and commitment are most prevalent among middle managers” (p. 1332). In their study, Fryer et al. (2018) came up with similar results. Surveying middle managers in healthcare, they found middle management commitment, front-line worker support, and organisational support to be crucial for lean to be successful while Lasrado and Nyadzayo (2020) identified middle management commitment as a critical success factor likewise.

Indeed, it is acknowledged that the middle management role in lean is critical. The literature, however, still remains quite fragmented. More precisely, the literature on middle management in lean misses a holistic perspective to date and requires a synthesis of the literature to explain their role in implementing and sustaining lean. In order to gain that holistic perspective of the middle management role in lean, we undertook an integrated literature review to answer the research questions as follows.

RQ. What is the middle management role in implementing and sustaining lean in organisations?

In this literature review, we attempt to review, organise and synthesise the existing literature on the middle management role in implementing and sustaining lean as opposed to the more

commonly investigated senior management role in change processes (Balogun & Johnson, 2004; Balding, 2005). We contribute with an integrative, conceptual model of the middle management role in lean. In doing so, we also counteract the lack of clarity what supportive management during lean implementation comprises (Marodin & Saurin, 2013; Holmemo & Ingvaldsen, 2016) and address the need “towards a better understanding of how ‘middles’ influence organisational transformation” (Balogun and Johnson, 2004, p. 523).

The remainder is structured as follows. First, we present our methodology. Second, we introduce to middle management more generally. Third, we discuss lean leadership practices at the middle management level. Fourth, we round up with a discussion and conclusion, including managerial implications and an agenda for future research.

2. Methodology

In order to pursue the objectives described, an integrative literature review approach was adopted (Torraco, 2005; Snyder, 2019; Elsbach & van Knippenberg, 2020; Fernández et al., 2020). Integrative literature reviews are defined as

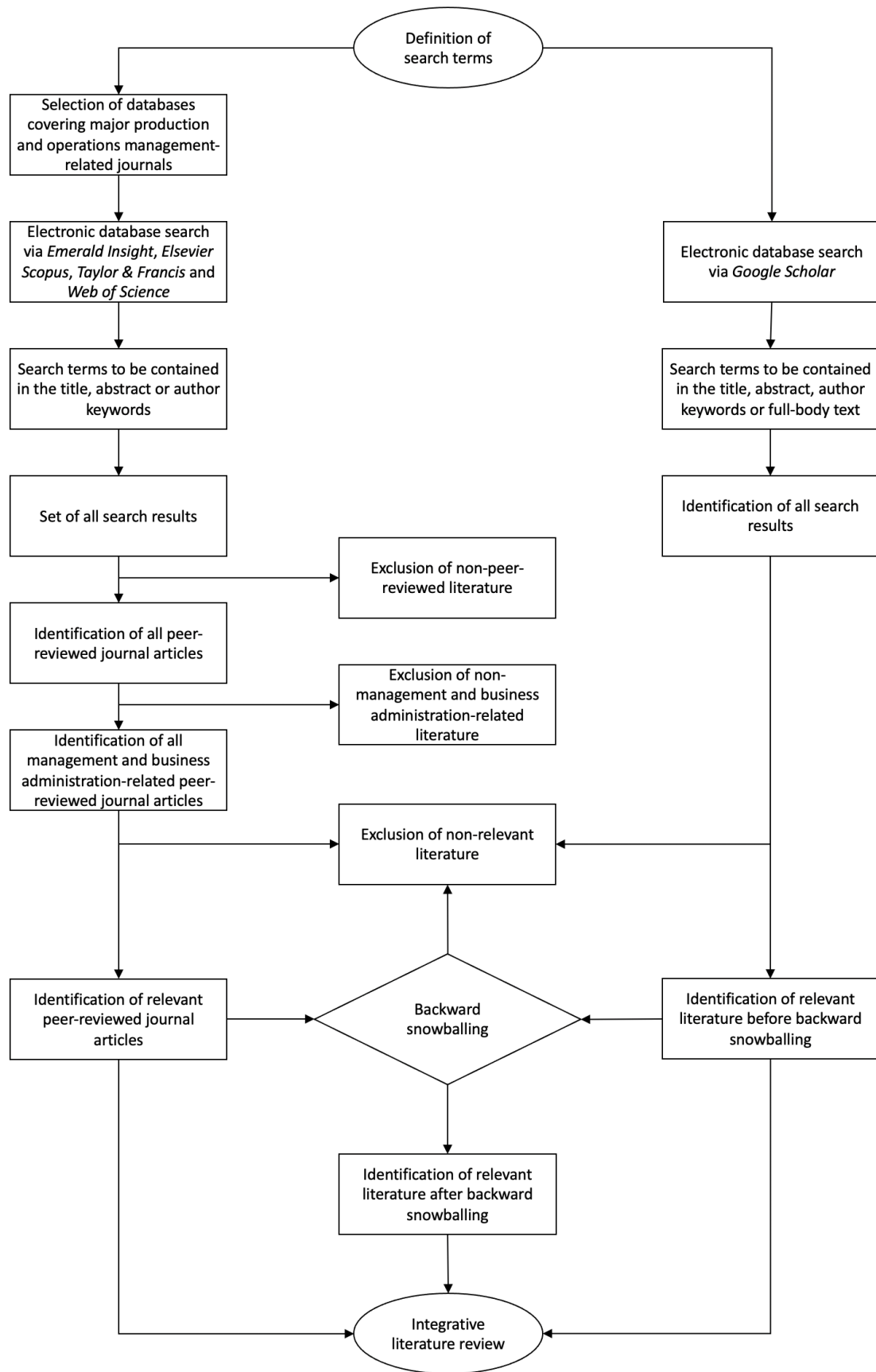
“reviews of the literature that move beyond description of a body of evidence to derive new insights through integration and/or critique” (Elsbach & van Knippenberg, 2018, p. 2).

Integrative literature reviews are used in two different cases – either to address a mature topic, which is then subject to a review, critique and a potential reconceptualisation or to address a new, emerging topic that would benefit from a holistic view to date. Typically, integrative literature reviews contribute with (1) a research agenda, (2) a taxonomy or other conceptual classification of constructs, (3) alternative models or conceptual frameworks, or (4) a metatheory (Torraco, 2005). In our case, we intend to review the literature on the middle management role in lean to elaborate an integrated, conceptual model to date (Snyder, 2019;

Elsbach & van Knippenberg, 2020), aligning with Torraco's (2005) third case of potential contributions of integrative literature reviews.

Although integrative literature reviews do not necessarily have to follow a systematic approach (Snyder, 2019), there is consensus upon transparency as being central to comprehensible integrative literature reviews, such as search terms and databases used (Torraco, 2005; Callahan, 2010; Synder, 2019). In the following, we, therefore, would like to elaborate on our methodology accordingly (Figure 1).

Figure 1. Integrative literature review methodology



Source: Authors

Initially, our focus of this integrative literature review was set on peer-reviewed journal articles available in the English language, deriving from multiple database searches where the selection of databases was made dependent on the production and operations management-related journals each database lists to ensure that renowned journals in the field were covered (Table 1).

Table 1. Database selection

No.	Production and operations management-related journals	Journal coverage per database				<i>f</i>
		<i>Emerald Insight</i>	<i>Elsevier Scopus</i>	<i>Taylor & Francis</i>	<i>Web of Science</i>	
1	<i>Business Process Management Journal</i>	○	○		○	3
2	<i>International Journal of Operations & Production Management</i>	○	○		○	3
3	<i>International Journal of Production Economics</i>		•			1
4	<i>International Journal of Productivity and Performance Management</i>	○	○		○	3
5	<i>International Journal of Productivity and Quality Management</i>		•			1
6	<i>International Journal of Lean Six Sigma</i>	○			○	2
7	<i>International Journal of Production Research</i>			•		1
8	<i>International Journal of Quality & Reliability Management</i>	○	○		○	3
9	<i>International Journal of Quality and Service Sciences</i>	○	○		○	3
10	<i>International Journal of Services and Operations Management</i>		•			1
11	<i>Journal of Cleaner Production</i>		•			1
12	<i>Journal of Manufacturing Technology Management</i>	○			○	2
13	<i>Journal of Operations Management</i>				•	1
14	<i>Manufacturing and Service Operations Management</i>		○		○	2
15	<i>Managing Service Quality: An International Journal</i>	•				1
16	<i>Production and Operations Management</i>		•			1
17	<i>Production Planning & Control</i>			•		1
18	<i>The TQM Journal</i>	○	○			2
19	<i>The TQM Magazine</i>	•				1
20	<i>Total Quality Management & Business Excellence</i>			○	○	2
Total		10(2)	12(5)	3(2)	10(1)	

Source: Authors

Note: (•) exclusive; (○) non-exclusive

In these databases, the search term syntax involved “middle AND lean OR middle AND improv* OR middle AND kaizen”, using Boolean connectors to improve the accuracy of our search results. By just using “middle” or even “middle manag*” the search results would have been too broad and unfocused. For instance, the number of search results with the search term “middle manag*” in *Elsevier Scopus* for peer-reviewed journal articles in the subject area of management and business administration amounted to 4,751. Therefore, we decided to narrow these results down by using secondary search terms in order to remain our focus on production and operations management-related literature and the objective of this review. While we chose “middle” as our primary search term, we decided to combine this term with secondary search terms, including “lean”, “improv*” and “kaizen”. As illustrated in Table 2, we found these search terms suitable due to their potential to cover other terminologies.

Table 2. Search term selection

No.	Search terms	Potential coverage examples
<i>Primary search term</i>		
1	Middle	Middle manager(s), middle management, middle-up-down, in/out of/from the middle, etc
<i>Secondary search terms</i>		
2	Lean	Lean, lean implementation, lean leadership, lean manufacturing, lean management, lean operations, lean practices, lean production, lean six sigma, lean thinking, lean transformation, etc
3	Improv*	(Continuous) improvement, improve, improving, etc
4	Kaizen	Kaizen, kaizen blitz, kaizen event(s), etc

Source: Authors

We limited our database searches to title, abstract and keywords. In some databases, an abstract (i.e. *Taylor & Francis*) or keyword search (i.e. *Emerald Insight*) was technically not supported. The initial search results were then filtered according to the subject area of management and business administration and scanned upon suitability by their title and by their abstract. Accordingly, non-management and business administration-related journal articles had been excluded throughout. In some minor cases, a brief keyword search was conducted within the

document to judge upon a journal article's suitability. Weeding out duplicates, we identified 22 journal articles as being suitable to initiate the integrative literature view from here on. At the same time, our searches in multiple databases unsurprisingly evidenced the scarcity of literature on the middle management role in lean, justifying our proposed research question (Table 3).

Table 3. Database search results^a

No.	Scope	Title search				Abstract search ^b				Keyword search ^c			
		<i>Emerald</i>	<i>Scopus</i>	<i>T&F^d</i>	<i>WoS^e</i>	<i>Emerald</i>	<i>Scopus</i>	<i>T&F^d</i>	<i>WoS^e</i>	<i>Emerald</i>	<i>Scopus</i>	<i>T&F</i>	<i>WoS^e</i>
1	All search results	10	1,241	120	1,187	647	69,888	–	47,402	–	109	13	67
2	Peer-reviewed journal articles	8	928	120	708	547	55,192	–	39,197	–	83	13	55
3	Subject-related journal articles ^f	–	22	6	8	–	1,245	–	281	–	19	2	3
4	Relevant journal articles	6	9	3	5	8	19	–	13	–	9	2	3
5	Post-duplicates per search	10				22				9			
6	Post-duplicates overall ^g					22							

Source: Authors**Note:** ^aAs of 31 August 2020; ^b*Taylor & Francis* do not provide an abstract search; ^c*Emerald Insight* do not provide a keyword search; ^d*Taylor & Francis*; ^e*Web of Science*;^f*Emerald Insight* do not provide a subject filter; ^gsee Appendix 1 for a detailed journal article list

Integrative literature reviews often attempt to explore the depth of a given topic and backtrace much of the literature back to its roots (Callahan, 2010). In any case, the inclusion of other literature was necessary, complementing the 22 journal articles identified. First, additional literature was identified by reading the ones that resulted from our initial database search (Torraco, 2005; Caiado et al., 2018). In doing so, three key articles involved Holmemo and Ingvaldsen (2016), van Dun et al. (2017) and Netland et al. (2019), guiding us to further literature desirous of the focus using backward snowballing (van Wee & Banister, 2012). Second, conducting a focused search via *Google Scholar* enabled to consider other relevant literature, also including some grey literature where relevant, as appropriate for integrative literature reviews (Whittemore & Knafl, 2005; Snyder, 2019). In addition, *Google Scholar* is a meta-search engine, covering a wide range of databases (Frank et al., 2017), and considers full-body text search, enabling to include journal articles that do not primarily focus on the middle management role in lean but find thematic discussion to some extent (e.g. Tortorella et al., 2017; 2019). In doing so, some journal articles further allowed to delve into some relevant literature in the areas of general and strategic management through backward snowballing likewise (e.g. Westley, 1990; Bartlett & Ghoshal, 1993; Floyd & Wooldridge, 1994; 1996; 1997; 2000; Dutton, 1997; Huy, 2001; 2002; Balogun & Johnson, 2004). Including Camuffo and Gerli (2005), Found et al. (2009) as well as Tortorella and colleagues (Tortorella & Fogliatto, 2017; Tortorella et al., 2017; 2019), *Google Scholar* identified several key articles. In Appendix 2, we illustrate our backward snowballing approach in detail.

3. Integrative literature review

3.1 Introducing middle management: definition and key activities

In most cases, a middle manager is defined as “any manager two levels below the CEO and one level above line managers” (Huy, 2001, p. 73). In the strategic management literature, plant

managers are considered as middle managers as well (Smith et al., 2009) while a “senior manager’ is defined as a member of a team of individuals [...] who, at the highest level of organisational management, have the day-to-day responsibilities of managing a corporation instead of the day-to-day activities of managing the business” (Found et al., 2009, pp. 4-5). Similarly, the strategic management literature makes a distinction between three different levels, namely (1) strategic management, (2) tactical management, and (3) operational management. Key activities of each level involve planning and control, that is, deploying or reviewing (Anthony, 1965). While senior management deploys goals and creates policy, middle management is responsible for deploying means and for reviewing to what extent strategy is translated at the operational level. That is, implementation plans are devised at the operational level while being monitored daily by lower management (Bicheno & Holweg, 2016). Middle management constitutes the intermediary between the site and first-line management, thus, supporting senior management to achieve strategic goals (Nonaka, 1996; Holmemo & Ingvaldsen, 2016). Along these lines, Table 4 summarises levels of planning and control and critical activities conducted at the three different levels.

Table 4. Corporate structure

No.	Planning and control		Management		
	<i>Level</i>	<i>Activities</i>	<i>Level</i>	<i>Role</i>	<i>Description</i>
1	Strategic management	Deploy goals Create policy Review means of tactical management	Senior management	Managing director	Chief executive Highest in organisational hierarchy Most decision power
				Senior managers	C-suite executive Highest in hierarchy of division/business unit
2	Tactical management	Deploy means Review actions of operational management based on means	Middle management	Plant managers ^a	General manager of the plant Translating strategy set by senior management into action
				Department managers	Highest in departmental hierarchy Intermediary between site management and first-line management Translating strategy set by the site and senior management into action
3	Operational management	Devise implementation plans Review actions on a day-to-day basis	Lower management	First-line managers	Lowest management level in the hierarchy Management of non-managerial staff
				Front-line managers ^a	Leader and supervisor of shopfloor operators

Source: Adapted from Anthony (1965), Bicheno & Holweg (2016) and Netland et al. (2019)

Note: ^aManufacturing example

In a survey, Sohal and Egglestone (1994) found that most companies perceive that senior management (66%) and middle management (57%) are still the drivers for change. Likewise, Netland's (2016) review on critical success factors for improvement initiatives suggests that "management commitment and involvement" is by far the most important one for lean implementation. In fact, senior and middle management play a crucial role in driving organisational change (Huy, 2002). Any improvement initiative requires support from the top of the organisation (Oakland, 2011; Holweg et al., 2018), as senior managers determine general policies (Bamford & Forrester, 2003) and provide a vision that guides the formulation of objectives at management levels below (Nonaka, 1988; Anand et al., 2009). In line with that, Holweg et al. (2018) argue that senior management sets directions and provides incentives indeed, yet middle managers are the ones who lead or champion change initiatives. Moreover, Bamford and Forrester (2003) point out that middle management is ultimately the ones who are majorly involved in the daily challenges, for instance, due to continuous interactions with internals and externals or due to supervision. Previous research already evidenced that middle managers have the most direct contacts inside and outside their department. Likewise, Madu et al. (1996) point out that middle managers are one of the best sources of information related to quality issues while Bartlett and Ghoshal (1993) argue that middle managers function as horizontal integrators who make sure that knowledge is disseminated in the organisation. Their 360° perspective enables them to resolve problems, to communicate in every direction and to influence those surrounding them (Floyd & Wooldridge, 1994; Dutton et al., 1997; Harrington & Williams, 2004). As Dutton et al. (1997) put it, "middle managers rather than the top managers [...] have their hands on the 'pulse of the organisation'" (p. 407), suggesting that their role is more cross-functional than ever in modern organisations (Roth, 1998; Huy, 2001; Bamford & Forrester, 2003). Depending on the degree of their

commitment, middle managers are the ones who either facilitate or inhibit the implementation of lean, as they are supposed to get the rest of the organisation involved (Oakland, 2011).

In any case, middle managers are emotionally closer to staff as opposed to senior managers and have a better understanding of individual needs during organisational change which makes them crucially important for sustaining the change momentum (Kanter, 1982; Huy, 2001). At the same time, middle managers gain their subordinates' trust (Lleo et al., 2017). Huy (2001) argues that middle managers are the ones managing

“the tension between continuity and change [...] keep[ing] the organisation from falling into extreme inertia or extreme chaos”. He concludes that they “may be the most effective allies of corner office executives when it's time to make major changes in businesses” (p. 73).

Investigating the creation of information in Japanese firms, Nonaka (1988) introduces the concept of middle-up-down management which describes the management of contradictions and gaps between the visionary and the existing as part of the role of middle managers.

“The essential logic of [middle-up-down] management is that top management creates vision or dream, and middle management creates and implements concrete concepts to solve and transcend the contradictions arising from gaps between what exists at the moment and what management hopes to create. In other words, top management creates an overall theory, while middle management creates a middle-range theory and tests it empirically within the framework of the entire organisation” (p. 17).

That being said, Nonaka (1988) points towards the ability of middle managers to reconcile strategic matters with daily challenges of the organisation, thus, being the vital link between senior management and staff due to having complete knowledge centred around strategy and operations (Kanter, 1982; Floyd & Wooldridge, 2000). Nonaka (1994)

recognises middle managers as “the true knowledge engineers” (p. 32) within organisations. Similarly, Floyd and Wooldridge (1996; 1997) suggest that middle management is aligning strategic and operational decision-making while Westley (1990) advocates that middle management constitutes a crucial source for discussing strategic matters. In their study, Wooldridge and Floyd (1990) even found that middle managers often feel that they are “in a better position to initiate and assess alternative courses of action” (p. 240) than senior management. As noted by Holmemo and Ingvaldsen (2016), the involvement of middle managers improves the quality of decision-making and negotiates consensus on change amongst parties concerned. Likewise, Wooldridge and Floyd (1990) suggest that the strategic involvement of middle managers increases the quality of decision-making, leading to improved organisational performance.

As discussed by Holmemo and Ingvaldsen (2016), organisations often install isolated lean experts who are supposed to convey the fundamentals of lean to the operational level. Although presumably well-intentioned, this approach, however, bypasses middle management and may result in “islands of excellence” (p. 26) as termed by Bicheno and Holweg (2016). Bypassing middle managers entails a lack of commitment on the part of the middle management level, which may rub off on the operational level and ultimately implicates a limited customer value. By implication, employees at the operational level may struggle to be granted additional time to dedicate themselves to CI projects, if middle management is not taken into confidence by lean experts.

In a later study, Holmemo et al. (2018) criticised the limited effectiveness of lean consultants that organisations with no or little lean experience bring in. Lean consultants take the roles of internal lean experts but bypass the middle management level in the same way. In addition to this, Holmemo et al. (2018) report that engaging the services of lean consultants has no or limited effects on the soft side of lean, as their findings show that

lean consultants influence the awareness-raising of soft lean indeed, yet implementations often remain tool-focused. The reasons behind this are down to the fact that lean consultants are not managers. In other words, lean consultants are not yet able to integrate the soft side of lean, such as participation and leadership, into their business model. That is not to say that lean consultants are unnecessary as they can be particularly useful during the early stages of the lean journey (Holmemo et al., 2018) but, as Rother (2010) accentuates, the soft side of lean evolves best as a result of internal efforts and commitment from line managers. That being said, Lleo et al. (2017), for instance, found that an increase in the trust that subordinates have in their middle managers enhances their CI commitment.

3.2 Middle management role in lean leadership

Several scholars report that a successful lean implementation requires cultural change (Liker, 2004; Mann, 2005; Bhasin & Burcher, 2006; Jørgensen et al., 2003; 2007; Anand et al., 2009; Poksinska et al., 2013; Glover et al., 2015; Hirzel et al., 2017; Hines et al., 2018; Holweg et al., 2018), yet, to do so, adequate leadership is necessary (Schein, 2010; Poksinska et al., 2013). In the literature, there are different conceptualisations of leadership, yet some commonalities can be identified. That is, leadership as such is a process. It involves influence, takes place within a social setting and follows a goal (Northouse, 1997; Poksinska et al., 2013).

In lean, leadership essentially relates to the lean-orientated involvement of employees to conduce lean implementation and its sustainability, characterised by a set of leadership behaviours that inspire and enthuse organisational members to embrace and embed a CI culture (Emiliani, 1998; Spear, 2004; Found & Harvey, 2007; Rother, 2010; Netland et al., 2019). In doing so, lean leaders are supposed to be transformational and to behave according to cultural expectations (i.e. “lean ideals”), disseminating the lean principles in

the entire organisation (Emiliani & Stec, 2005; Suresh et al., 2012; Tortorella et al., 2018). Acting as “‘culture carriers’ to implement the lean programme” (Poksinska et al., 2013, p. 896), lean leaders act as role models (Dombrowski & Mielke, 2014). In their study, Poksinska et al. (2013) demonstrated that during the beginning of lean evolution, implementation activities highly depend on “managerial push” (p. 898) while employee pull will set in once the cultural change is achieved. In recent time, Tortorella et al. (2017) examined the relationship between the behavioural orientation of leaders across the hierarchy and lean evolution. They found that middle managers’ behaviour is likely to be more task than relation-orientated during the early stages of lean implementation. As lean evolves, however, this behavioural orientation is likely to shift from task to relation. This circumstance is explained by an initial incapability, unwillingness or fear to do the job in which a middle manager has to guide, to direct and, if necessary, to persuade the individual. A relational orientation, however, is necessary to sustain current improvements in particular (Womack & Jones, 2003; Mann, 2009; Rother, 2010; Tortorella et al., 2017).

Indeed, organisations aim to achieve CI with lean initiatives. In many cases, however, engaging employees often turns out to be challenging. According to Liker and Convis (2011), “the biggest gap in capabilities in the lean movement, and the root cause of failure in many lean programmes, is in leadership” (p. xiii). That is, lean implementation arouses expectations of leaders’ behaviours (House et al., 2004; Poksinska et al., 2013; Tortorella & Fogliatto, 2017), defined as being directly observable, (non-)verbal actions of lean leaders, during organisational interactions with subordinates (van Dun et al., 2017). In their systematic literature review, van Dun et al. (2017) scanned 515 articles and one relevant book (Liker & Convis, 2011). They found that engaging employees in CI is the lean leadership behaviour most referred to, yet Netland et al. (2019) limit this capability

to a “good lean leader” (p. 8). Besides, “celebrating and recognising success”, “designing and coaching teams”, “getting and giving information” and “visiting the work floor” are represented frequently and seem of high relevance (van Dun et al., 2017).

Often misunderstood, 80% of the lean efforts relate to *changing* leaders’ behaviours, their practices and their mindsets while at most 20% of them concern the adoption of hard lean practices (Mann, 2009). That is, lean requires a strengthening of the leadership role (Netland et al., 2019) due to the crucial role leaders play in embedding an underlying culture of principles that sustains lean (Hines et al., 2004; Bhasin & Burcher, 2006; Shook, 2010; Tortorella & Fogliatto, 2017; Laureani & Antony, 2018). This being the case, some scholars refer to the importance of leaders at the middle management level in particular (e.g. Harrington & Williams, 2004; Emiliani, 2008; van Dun et al., 2017).

Being described as “the missing link” in lean practice and research (Roth, 1998; Mann, 2009), “lean leadership” gained recently greater attention in the lean literature (Mann, 2009; Dombrowski & Mielke, 2014; Tortorella et al., 2017; 2018; van Dun et al., 2017; Netland et al., 2019; Seidel et al., 2019). In lean-adopting organisations, lean leadership is most important at the middle management level because responsibilities often reside right there (Tortorella et al., 2017; van Dun et al., 2017). That is, middle management is

“usually responsible for translating corporate strategy into operational routines; lean initiatives then often fall upon middle managers” (Tortorella et al., 2017, p. 868).

Also, middle managers are tasked with effectuating top-down mandates through shopfloor operationalisation (Nonaka, 1994; Lam, 1996; Holmemo & Ingvaldsen, 2016; van Dun et al., 2017). Not surprisingly, an array of lean leadership models has emerged in the literature over time (Spear, 2004; Mann, 2009; 2014; Liker & Convis, 2011; Martyn & Crowell, 2012; Dombrowski & Mielke, 2014; Aij & Teunissen, 2017; Netland et al., 2019). In each lean leadership model, managerial lean practices for a successful lean

implementation are suggested. Indicating alignment to a large extent, we have aggregated these principal elements into six managerial lean practices to provide a structured approach to our discussion on lean leadership at the middle management level (Table 5).

They include:

- (1) policy deployment (“hoshin kanri”);
- (2) leader standard work;
- (3) continuous improvement promotion;
- (4) self-development;
- (5) coaching;
- (6) gemba walks.

Table 5. Integrating lean leadership models

No.	Managerial lean practices	Lean leadership models					
		<i>Spear (2004)</i>	<i>Mann (2009; 2014)</i>	<i>Liker & Convis (2011)</i>	<i>Martyn & Crowell (2012)</i>	<i>Dombrowski & Mielke (2014)^a</i>	<i>Netland et al. (2019)</i>
1	Policy deployment (“hoshin kanri”)			Create vision and align goals	Strategy deployment	Hoshin kanri	Strategic alignment
2	Leader standard work		Leader standard work Daily accountability		Standard follow-up		Daily layered accountability
3	Continuous improvement promotion	Structured experiments Experiments as frequently as possible	Visual controls	Support daily kaizen	Daily kaizen Visual management	Improvement culture	Continuous improvement Structured problem-solving
4	Self-development			Self-development commitment		Self-development	
5	Coaching	Coaching – not fixing		Coach and develop others		Qualification	Coaching
6	Gemba walks	Direct observation				Gemba	Go and see

Source: Authors

Note: ^aAij and Teunissen’s (2017) lean leadership model is based on Dombrowski and Mielke (2014).

3.2.1 Policy deployment (*“hoshin kanri”*)

Although there is confusion regarding its actual translation (Witcher & Butterworth, 1999), the Japanese term “hoshin kanri” refers somewhat to “targets and means management” and relates to strategy or policy deployment (Tennant & Roberts, 2001a; Witcher et al., 2008). Akao (1991) defines hoshin kanri as

“[...] all organisational activities for systematically accomplishing the long and mid-term goals as well as yearly business targets which are established as the means to achieve business goals. In many cases it is used for yearly targets” (p. 47).

Through a simultaneous vertical and horizontal alignment, the corporate vision develops strategic objectives for the firm to derive aligned targets for each individual so that the whole workforce focuses on the corporate objectives and thus on the same vision (Dombrowski & Mielke, 2014; Bicheno & Holweg, 2016). Following this, hoshin kanri is an organisation-wide management system for planning and control that involves the entire workforce through a systematic breakdown of the vision into aligned targets for each individual (Bicheno & Holweg, 2016).

In particular, hoshin kanri emphasises top-down and bottom-up involvement in which middle management constitutes the vital link. As to top-down, senior management deploys goals for middle management while middle management deploys means to reach the goals set by senior management (cf. Table 4). Finally, implementation plans are devised at lower management levels (Jolayemi, 2008; Bicheno & Holweg, 2016; Netland et al., 2019). Hoshin kanri further entails a bottom-up approach, seeking long-term vision to achieve CI through challenging the current-state processes for value creation (Tennant & Roberts, 2001a). In this process, middle managers have a strong influence on strategy

adaption because they choose *when*, *where* and *how* issues are brought to senior management's attention (Dutton et al., 1997).

Also, first-line or middle managers make sure that improvement suggestions resulting from employee involvement are in line with the overall strategy, fit into the whole system and improve the overall performance of the organisation. They, thus, do not only function as a “quality gate” but are also conducive to promoting systemic thinking, so that improvements become focused (Bessant et al., 1994). In contrast, singular traditional top-down approaches (e.g. management by objectives) are not conducive to bottom-up communication and limit the potential for organisational learning (Tennant & Roberts, 2001a).

Involving employees in strategy deployment has always been a challenge in western countries. Hoshin kanri, however, aims at solving this issue through the “catchball” process (“nemawashi” in Japanese; Jolayemi, 2008), integrating strategy and TQM principles (Tennant & Roberts, 2001b). To put it in Kondo's (1998) words,

“the discussion of top-down targets focuses mainly on the necessity of achieving the targets in order to satisfy customer requirements, secure profits, or increase market share” while “the discussion of bottom-up targets focuses mainly on the possibility of achieving them – finding the best methods of achieving them, identifying possible obstacles to their achievement, and finding ways of eliminating such obstacles” (p. 429).

Following this, senior management issues policy proposals to each department which will be reviewed. In this, each department evaluates its proposal, including employees from the middle and lower management level (Kondo, 1998; Jolayemi, 2008; Netland et al., 2019). Information flows vertically as well as horizontally (Bicheno & Holweg, 2016) while cross-functional discussions on the policy proposal with other departments ensure alignment and provide a better understanding of the policies in other parts of the

organisation (Kondo, 1998). More importantly, these discussions seek consensus on the deployment of targets and means (Tennant & Roberts, 2001b; Netland et al., 2019). Bicheno and Holweg (2016) point out that an agreement must be achieved through consensus and negotiation rather than through authority. Upon consensus, middle management communicates the goals to their teams. Alternatively, middle management feedbacks suggestions for optimisation to senior management (Kondo, 1998) in order to reconcile strategic matters with daily challenges (Nonaka, 1988; Floyd & Wooldridge, 1996). Indeed, this circumstance shows that middle managers constitute the centrepiece in the catchball process. In particular, Kondo (1998) underlines that this way of strategy deployment is a significant motivator for individuals to achieve their targets. At the same time, it is likely that layering management levels may likely foster communication and leverage participation and commitment to lean (Åhlström, 1998; Åhlström & Karlsson, 2000; Benders & van Bijsterveld, 2000).

In principle, the hoshin kanri literature points towards middle management's "double-agency role" in cohering senior management and the shopfloor while middle managers provide the required means to achieve the strategic goals.

3.2.2 Leader standard work

Indeed, the degree of standardised work becomes lesser as one moves up the organisation's hierarchy (Mann, 2005; Netland et al., 2019), yet a lean-adopting organisation presupposes engaged managers who verify whether CI is taking place (Mann, 2009; Tortorella et al., 2017). That being said, any manager is encouraged to practise leader standard work (LSW), constituting standard routines for leadership tasks incorporated into their daily activities (Liker & Convis, 2011; Poksinska et al., 2013; Found & Bicheno, 2016). Described as "the engine of lean management" (Mann, 2005, p. 25), LSW defines routines, ensuring a standardised execution of processes in order to

achieve less variation and further “captures the cumulative to-date essence of an organisation’s best practices in lean management” (p. 26) while improvements result from preserved experiences (Mann, 2005).

In practice, LSW is associated with a schedule of activities that is followed by each leader (Mann, 2005; Bicheno & Holweg, 2016) and counteracts a lack of definition of roles and responsibilities as often criticised by middle managers (Lodgaard et al., 2016). Even if the nature of standard routines for leadership tasks is not extensively specified in the vast literature on lean, Found and Bicheno (2016) include “morning meetings, audit checks, and problem escalation procedures to reduce problems” (p. 30). In a lean-adopting organisation, members at the middle management levels are expected to participate in daily huddle (i.e. short stand-up) meetings to receive an update from different departments on the current condition in operations (Mann, 2014; Netland et al., 2015; 2019). In order to address the issues identified in the huddle meeting, middle managers then share the action plan agreed with front-line employees who intervene in their respective area. That being said, daily accountability also includes

“a meeting structure aiming to ensure follow-up on task assignments made in response to emerging problems or opportunities for improvement” (Poksinska et al., 2013, p. 888).

Likewise, Mann (2005; 2009) refers to the conduct of gemba walks, holding meetings and standard work monitoring as part of middle managers responsibility which also receives support from Liker and Convis (2011). Furthermore, Bicheno and Holweg (2016) see morning meetings with fixed durations, gemba walks, performance reviews and kaizen event plans as an essential part of LSW. In his book, Mann (2005) describes how LSW layers these activities from bottom-up, yet with some redundancy involved to ensure linkage between each management level.

Daily routines help middle managers to shift their mere focus from outcomes to a

combination of both processes and outcomes (Mann, 2005; 2009). While new hires and appointments to leading positions are often associated with “a ‘new-sheriff-in-town’ mentality accompanying change” (Mann, 2005, p. 26), LSW is process-dependent rather than person-dependent and seeks to focus on improvements of leaders’ standardised work to reduce variation (Mann, 2005; 2009). In fact, Holweg et al.’s (2018) study shows that changes in lean-leading positions at the senior and middle management level worsen performance outcomes by 6% after a year already. In other words, every time a new middle manager joins, activities and operations should continue pretty much as they are on the premise that processes have been in a stable state. In this way, LSW makes lean also more accessible to inexperienced middle managers and enables them to leverage their performances from “average” to “above average” (Mann, 2005).

Thus, being the centrepiece between senior and lower management, LSW practice becomes particularly important at the middle management level, ensuring that strategy is translated into operationalised actions and that accountabilities are met and followed up. At the same time, LSW promotes lean at the operational level ongoingly, encouraging cultural change over time. In doing so, LSW enables that the returns from a lean transformation are sustained and extended (Mann, 2009) and unveils managers who are not willing to exert newly defined standards for expected behaviour. Research suggest that 10-20% of leaders do not comply with it (Mann, 2005).

3.2.3 Continuous improvement promotion

In essence, the literature refers to lean leaders’ dedication to CI and incremental improvements daily. Equally, structured problem-solving activities, where resources are made available and stumbling blocks encountered by individuals or the CI team are addressed, are concerned (Spear, 2004; Found & Harvey, 2007; Liker & Convis, 2011; Poksinska et al., 2013; Netland et al., 2019). Lean leaders should function as facilitators

who interact with employees to instil CI (Mann, 2005; Poksinska et al., 2013; Laureani & Antony, 2018). That is, CI follows a structured problem-solving approach counteracting variation and non-conformance in lean organisations and usually beginning with grasping the current condition. In order to reach the next target condition defined, obstacles to be overcome are identified and analysed, building the basis for an action plan that addresses each of the challenges (Rother, 2010).

In particular, middle managers are considered as initiators and CI champions (Spear, 2004; Holmemo & Ingvaldsen, 2016; Holweg et al., 2018). In lean organisations, CI is fundamentally embedded in everyday work indeed, yet, as outlined, encouraging employees to engage in CI is far from being straightforward and requires excellent leadership skills (Netland et al., 2019). Based on a sample of 55 different middle managers, Lleo et al. (2020) found that operators' participation in CI is enhanced if middle managers display behavioural traits relating to human qualities, training and development, technical and managerial competencies and foster teambuilding. Beyond question, it is middle managers' responsibility to create a work environment which enables CI engagement, and which holds employees accountable. In their book, Martyn and Crowell (2012) describe this as creating a culture of daily kaizen where improving the work is the work. In contrast, a lack of support from middle management is likely to restrict the time subordinates participate in CI activities (Marodin & Saurin, 2015).

In the literature, various means of promoting CI are described. In order to encourage subordinates' buy-in, Holweg et al. (2018) advise managers to guide meaningful improvements which may resolve pain points and are of real value to those involved in the process. Especially harnessing the power of small quick wins, they argue, fosters continued engagement between managers and front-line staff. The ability to engage in meaningful improvements is perceived as the strongest motivator to embed a CI culture

(Amabile & Kramer, 2011), yet the support for teamwork (e.g. Found & Harvey, 2007; Liker & Convis, 2011; Poksinska et al., 2013), visual management (e.g. Martyn & Crowell, 2012; Poksinska et al., 2013; Mann, 2014; Netland et al., 2019), and the provision of suggestion systems seem to appear most frequently in the literature (e.g. Boer et al., 2000; Rother, 2010; Bicheno & Holweg, 2016; Netland et al., 2019). Although the effectiveness of suggestion systems is controversial in the literature (Rother, 2010), it is ultimately the first-line or middle manager who is actively monitoring it (Netland et al., 2019).

Lean postulates a no-blame culture inferring that lean leaders should be cautious about their reaction upon occurring mistakes and non-conformances caused by individuals (Mann, 2005; Poksinska et al., 2013). Indeed, mistakes and non-conformances constitute waste and can be very frustrating if they occur multiple times, yet individuals are also supposed to be recognised for their honesty of confessing mistakes and the detection of non-conformances according to lean principles (Dombrowski & Mielke, 2014). Throughout, leaders – especially, middle managers – are protagonists in shaping organisational culture (Schein, 2010). In consequence, middle managers must shape that no-blame culture and ensure that it is maintained. As reported by van Dun et al. (2017), effective middle managers rather recognise their followers, encourage failure reporting by front-line employees and give constructive feedback as CI encompasses a continuous learning process where mistakes are a part of the learning process (Dombrowski & Mielke, 2014).

3.2.4 Self-development

At the same time, middle managers are not freed from making mistakes at all. They perform vital functions in terms of leadership and support subordinates which requires new capabilities and attitudes on their part in turn (Harrington & Williams, 2004). In fact,

middle managers' capacity and capability development has an influence on the CI momentum (Hartviksen et al., 2020). Accordingly, a strong commitment to self-development ("hansei" in Japanese) is needed (Liker & Convis, 2011; Poksinska et al., 2013; Netland et al., 2019).

The circumstance that middle managers' lean education is the first step to success (Anand, 1996; O'Meara & Centers, 1999) induces lean-performing organisation like Toyota to follow an approach in which they seek upskilling all their middle managers (Spear, 2004; Anand et al., 2009). In an empirical study, Anand et al. (2009) identified within five successful CI organisations that all of them do not only recognise the relevance of employee engagement but mainly focus on the development of their middle managers, thus, putting less emphasis on staff at the operational level who execute the day-to-day operations. In contrast, these organisations aim at instilling the CI methodology into their middle management through training, so that they stimulate the excitement at the operational level in turn. They reported that the conveyance of leadership techniques amongst middle managers reinforces this process. Likewise, Manville et al. (2012) identified in a single case study the relevance for developing the learning capabilities of middle managers. Based on their findings, the authors suggest empowering them to have more influence on improvement and strategic matters. Their findings also highlight critical success factors that middle managers value, including senior management commitment, support and enthusiasm as well as training and education amongst four others, yet, at the same time, criticism of middle managers often centres around a lack of senior management commitment, support and enthusiasm as well as a lack of training and education.

3.2.5 Coaching

In order to enable coaching capabilities, self-development is considered as a necessary precondition (Poksinska et al., 2013) as middle managers are in charge of guiding and verifying front-line managers' behaviours, and responsible for developing their skillsets on their daily duties (Mann, 2009; Engle et al. 2017; Tortorella et al., 2017). In other words, middle management is supposed to identify individual learning needs and to provide training for daily key activities. Indeed, this approach contradicts both "hire and fire" attitudes and frequent job transfers (Emiliani, 2008; Liker & Convis, 2011; Dombrowski & Mielke, 2014). Ideally, coaching should follow a top-down approach in which every leader is capable of coaching their subordinates. That is, subordinates, in turn, coach *their* subordinates. In lean, this logic is termed as "train the trainer" (Netland et al., 2019).

In his book, Liker (2004) describes how leaders at Toyota are respected for their in-depth technical understanding and their way of leading people. Their main task, however, is not necessarily to improve but rather to instil the underlying lean principles as well as the corporate values and cultural norms and to develop the CI capabilities of their subordinates (Spear, 2004; Rother, 2010; Poksinska et al., 2013; van Dun et al., 2017; Holweg et al., 2018; Netland et al., 2019; Seidel et al., 2019). Accordingly, lean leadership at the middle management level is needed to close cultural gaps in the organisation (Poksinska et al., 2013) and to ensure a sustained promotion of lean to drive change (Found, 2006; Hines et al., 2008; Rother, 2010; Netland, 2016). Lean leaders motivate, develop individuals and teams, and promote organisational learning and knowledge exchange (Mann, 2005; Poksinska et al., 2013). As Huy (2001) recognises middle managers' reach and connections at different levels within the organisation, it

becomes clear that middle managers carry weight in knowledge dissemination (Nonaka, 1994).

Continuing on this, Hølememo et al. (2018) underline the vital role that the middle management level plays in promoting the soft side of lean, such as participation, training and leadership. Middle management, as change agents, are essential for organisational sensemaking, that is, developing a clear narrative and making sense of the lean transformation (Balogun & Johnson, 2004; Huy, 2011; Holweg et al., 2018). In Balogun and Johnson's (2004) words, middle managers support as their subordinates undergo

“a conversational and narrative process through which [they] create and maintain an intersubjective world” and “start to act in a more conscious [...] mode and to interact with each other to make sense of what is going on around them and to determine how they should respond” (p. 524).

In many organisations, however, managers feel confident about knowing the best solution to a problem and name it, yet this attitude discourages individuals to utilise their problem-solving capabilities (Spear & Bowen, 1999; Spear, 2004; Rother, 2010; Dombrowski & Mielke, 2014). Similarly, van Dun et al. (2017) argue that rather than welcoming change efforts, middle managers are often prone to stick with their command and control style. Instead, coaching should be carried out to encourage a mindset shift where they take a holistic systems perspective when monitoring or directing their subordinates in problem-solving or CI activities (Spear & Bowen, 1999; Liker, 2004; Spear, 2004; Rother, 2010; Poksinska et al., 2013; Dombrowski & Mielke, 2014).

Moving away from “experting”, effective lean middle managers develop their subordinates' structured problem-solving skills (van Dun et al., 2017; Holweg et al., 2018). Improvement kata (“way of doing”) constitutes a scientific routine to process development that complements the coaching kata (“way of coaching”) for employee

development (Rother, 2010; Dombrowski & Mielke, 2014). A kata coach trains his or her subordinates to practise the improvement kata in order to enhance their structured problem-solving skills. In practice, the improvement kata is associated with empowerment (Rother, 2010) while, at the same time, the middle management role appears to be “hollowed out” (Delbridge et al., 2000, p. 1459) because subordinates take more responsibility for some daily activities. That is, Holweg et al. (2018) propose to provide “*freedom within a frame* [italics in original]” (p. 13). In other words, boundaries are defined within which lean can be carried out to enable an improvement of the current condition while maintaining control over the process. Indeed, Huy (2001) poses middle managers’ entrepreneurial mindsets. In contrast, however, the improvement kata aims at sparking subordinates’ entrepreneurial mindset. Rather than fixing the issue (Spear, 2004), the middle manager is responsible to coach a way of thinking and acting that enables his or her subordinates to reach the next target condition (Rother, 2010). In many cases, the coaching kata is manifested through Socratic questioning during gemba walks (Seidel et al., 2019). Integrating both routines, that is, the improvement and the coaching kata, results in a shared way of thinking and working (Rother, 2010).

3.2.6 Gemba walks

A gemba walk is associated with “go and see” (“genchi genbutsu” in Japanese) and constitutes a critical problem-solving tool as frequently commended in the lean academic literature (e.g. Spear, 2004; Mann, 2005; 2009; Aij et al., 2015; Bicheno & Holweg, 2016; van Dun et al., 2017; Camuffo & Gerli, 2018; Netland et al., 2019; Seidel et al., 2019). While “gemba” is Japanese and refers to “the real place” where value is created, the term gemba walk is used to describe the activity in which lean leaders attend the shopfloor to see the value creation firsthand (Dombrowski & Mielke, 2014; Seidel et al., 2019). According to Spear (2004), “[t]here’s no substitute for direct observation” (p. 5). In

general, gemba walks consist of a three-part rule, that is, (1) going to the place, (2) observing the process and (3) talking to people (Mann, 2009; Seidel et al., 2019).

A gemba walk gets senior and middle managers to the front line and enables them to identify waste and improvement opportunities, sustaining and extending the gains from lean (Mann, 2009; Aij & Teunissen, 2017). Notably, however, the purpose of gemba walks remains an increased interaction with shopfloor employees for a better identification of non-conformance from the standard. Employee involvement is often achieved through Socratic questioning (Aij & Teunissen, 2017).

Value usually flows horizontally, while organisations are structured vertically. In other words, the direction is usually sought from the top while value creation takes place at the operational level. Gemba walks, however, enable middle management to understand the daily challenges their employees deal with (Aij & Teunissen, 2017). Likewise, they enable middle management to maintain a balance between management's vision and operational challenges (Nonaka, 1988; Floyd & Wooldridge, 1996; Womack & Shook, 2011; Schell & Kuntz, 2013). This leads to views, such as the one from Dombrowski and Mielke (2014) who argue that

“decision-making should be removed from conference rooms back to the shop floor [because] only if leaders put themselves in the employee's shoes at the very place where his work is done, they can really understand his [or her] problems and their root causes” (p. 569).

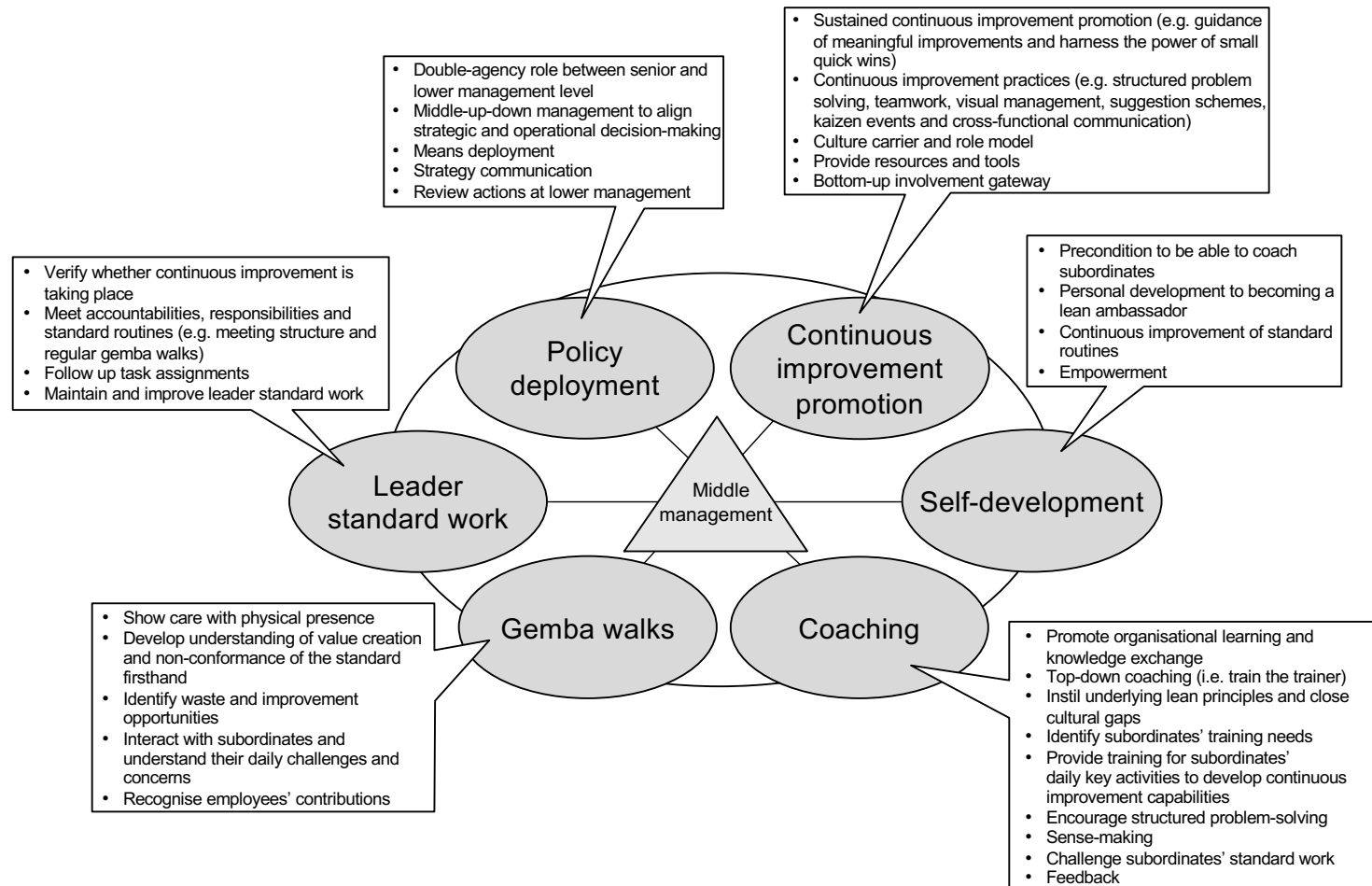
In plants with more mature lean implementations, senior and middle managers carry out regular gemba walks and interact with shopfloor employees on a face-to-face basis to appreciate their CI involvement (Netland et al., 2015). Ideally, engagement and care are demonstrated, and employees' contributions are recognised (Aij et al., 2015; Aij & Teunissen, 2017). In their study, van Dun et al. (2017) found that effective lean middle managers engage more in active listening, making them more receptive for employee

concerns. Increasing effects of gemba walks are very likely to be achieved once they are carried out publicly (Aij & Teunissen, 2017).

4. Discussion and conclusion

To date, the majority of studies on organisational change have focused on the senior management role (Balogun & Johnson, 2004; Balding, 2005) while there is some traction in the academic literature for researching the middle management role in lean (Camuffo & Gerli, 2005; Marodin & Saurin, 2013; Holmemo & Ingvaldsen 2016; Netland et al., 2019). That being said, our integrative literature review is an attempt to develop a picture of the current-state knowledge of the middle management role in implementing and sustaining lean. We contribute with a holistic view on the middle management role in lean to date summarised in an integrative, conceptual model (Figure 2). Although literature of this kind is limited and quite fragmented as yet, several valuable conclusions can still be drawn.

Figure 2. Integrative, conceptual model of the middle management role in lean^a



Source: Authors

Note: ^aSee Appendix 3 for supplementary information.

In summary, we demonstrate that middle managers are the protagonists in lean evolution and indispensable for sustainable success. In operationalising strategy, middle managers reconcile senior management's vision with daily challenges at the operational level, integrating bottom-up involvement into top-down mandates. In particular, regular gemba walks allow middle managers to engage and interact with their subordinates, and to understand the daily challenges on the front line to make their tactical decisions more evidence-based. In acting as cultural change agents, middle managers sustainably promote lean and support the transition towards a lean organisation through managerial push and soft lean evolvement, shaping and maintaining a CI-orientated culture by engaging, inspiring and enthusing the wider workforce. Due to their deep networks at different levels within the organisation, middle managers are key to knowledge dissemination, yet, at the same time, the necessity for self-development is recognised as a precondition to be able to coach subordinates so that CI capabilities and problem-solving skills can be enabled at the operational level.

We suggest that the six managerial lean practices are not mutually exclusive but interdependent. For instance, coaching takes often place at the gemba while gemba walks should be part of a middle manager's daily accountabilities. Neglect of one element may rub off on another. In consequence, we propose that all elements are equally important attributes of the middle management role in lean and essential to implement lean successfully and to sustain its gains.

4.1 Managerial implications

In terms of managerial implications, we believe that the integrative review has raised awareness regarding the critical role of middle management in implementing and sustaining lean. In particular, the proposed integrative, conceptual model may benefit senior managers as they may review their current expectations of roles and

responsibilities at the middle management level. Along these lines, some recommendations can be articulated. That is, first and foremost, a mindset shift at the “C-suite” level is required. As Found (2006) points out, poor leadership is one of the causes of low lean sustainability. In order to achieve lean sustainability, however, lean-committed senior managers who provide the resources, such as training and education, and support to overcoming barriers, are the precondition. In this case, middle managers can become coaches and mentors of their subordinates, develop to cultural change agents and unleash their full potential. Indeed, hard lean education (i.e. focus on tools and techniques) at the middle management level is the first step to success, yet middle managers also need to learn competencies related to human relations. Second, taking the role of middle management in strategy development and deployment into account, it becomes evident that senior managers have to pass on the corporate-level picture to middle management in order to enable this leadership group to translate that strategy into viable, operationalisable measures. Third, in lean-adopting organisations, most responsibilities often reside at the middle management level. In accordance, senior management must strengthen and empower the middle management role to reach their full potential while refraining from too much involvement at the tactical and operational level at the same time (i.e. avoidance of micromanagement). Fourth, senior and middle management should align upon leadership routines to be practised, so that daily responsibilities and accountabilities are clearly defined. If these are followed up regularly under LSW, middle managers ensure a sustained promotion of lean at the operational level, reinforcing the evolution of lean implementation capabilities to drive CI from bottom-up while achieving a cultural change in the long-term.

4.2 Limitations and agenda for future research

Despite its potential to serve for future research, this piece of work is not entirely free from limitations. First, our findings require more empirical validation. We encourage empirical research, not only to validate our findings, but also in a general sense as empirical research to date on the role of middle managers in implementing lean still remains relatively sparse (Camuffo & Gerli, 2005; Holmemo & Ingvaldsen 2016; Netland et al., 2019). We need to objectively measure the impact of middle managers in sustaining lean with the six managerial lean practices acting as an input for lean sustainability and serving as the dependant variable. Future research may benefit from applying the structured equation modelling approach to quantify the individual contribution of each of the six managerial lean practices in the conceptual model on lean sustainability. Second, further research is required to know more about the individual needs of middle managers to enable them to initiate change and how they develop through a lean programme. Similarly, the literature lacks insights on how new middle managers are integrated into lean-performing organisations. With the latter, it may be important to observe new hires at the middle management level within a longitudinal study to find out more about their behaviour changes over time and how they may break old habits considered as non-lean. Third, integrative literature reviews tend to enforce “inside-the-box” thinking. Alvesson and Sandberg (2020), for instance, describe how review articles

“function as an ordering mechanism of the research community, in that people may feel instructed to master what is reviewed, not necessarily to consider other literatures or ways of framing the field” (p. 1296).

In our context, we mainly focused on production and operations management-related literature on middle management. In other literature streams, such as general management, strategic management, human resource management or organisational

behaviour, more insights on middle management may be found and transferred to the lean context. In this regard, future research may conduct a systematic literature review entirely on middle management in order to identify whether anything has been missed or whether there are additional avenues to frame the middle management role in lean.

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Appendix 1. Integrative literature review

No.	Author/s (year)	Journal ^a	Citations ^b	Type	Country	Industry
<i>Primary search via databases</i>						
1	Alhaqbani et al. (2016)	<i>BPMJ</i>	18	Empirical	Saudi Arabia	Public
2	Anand (1996)	<i>TQM</i>	12	Viewpoint		
3	Balding (2005)	<i>IJHC</i>	48	Empirical	Australia	Healthcare
4	Delbridge et al. (2000)	<i>HR</i>	156	Empirical	Multiple western	Manufacturing
5	Engle et al. (2017)	<i>HCMR</i>	77	Empirical	United States	Healthcare
6	Fryer et al. (2018)	<i>HCMR</i>	12	Empirical	United States	Healthcare
7	Hartviksen et al. (2020)	<i>LHS</i>	0	Empirical	Norway	Healthcare
8	Harrington & Williams (2004)	<i>MSQ</i>	53	Conceptual		
9	Holmemo & Ingvaldsen (2016)	<i>TQMBE</i>	48	Empirical	Norway	Public
10	Jørgensen et al. (2003)	<i>IJOPM</i>	148	Empirical	Denmark	Manufacturing
11	Kanter (1982)	<i>HBR</i>	673	Viewpoint		
12	Lam (1996)	<i>JMD</i>	77	Empirical	Hong Kong, SAR	Multiple
13	Lasrado et al. (2020)	<i>IJQRM</i>	0	Empirical	United Arab Emirates	Multiple
14	Lleo et al. (2017)	<i>TQMBE</i>	17	Empirical	Spain	Manufacturing
15	Lleo et al. (2020)	<i>IJQSS</i>	0	Empirical	Spain	Manufacturing
16	Manville et al. (2012)	<i>IJQRM</i>	204	Empirical	United Kingdom	Information Technology
17	Marodin & Saurin (2015)	<i>JMTM</i>	68	Empirical	Brazil	Multiple
18	Netland et al. (2019)	<i>IJLSS</i>	2	Viewpoint		
19	Roth (1998)	<i>TTQMM</i>	13	Viewpoint		
20	Schell & Kuntz (2013)	<i>ENMJ</i>	18	Meta-analysis	Multiple	Multiple
21	van Dun et al. (2017)	<i>EUMJ</i>	91	Empirical	The Netherlands	Multiple
22	Wooldridge & Floyd (1990)	<i>SMJ</i>	1,295	Empirical	n/a	Multiple
<i>Secondary search via Google Scholar</i>						
1	Bamford & Forrester (2003)	<i>IJOPM</i>	456	Empirical	United Kingdom	Manufacturing
2	Bicheno & Holweg (2016)		870	Textbook		
3	Camuffo & Gerli (2005)		10	Empirical	Italy	Manufacturing
4	Found et al. (2009)		19	Empirical	Multiple European	Multiple
5	Holmemo et al. (2018)	<i>TQMBE</i>	20	Empirical	Norway	Public
6	Holweg et al. (2018)		7	Empirical	Multiple European	Banking

No.	Author/s (year)	Journal ^a	Citations ^b	Type	Country	Industry
7	Jolayemi (2008)	<i>TQM</i>	62	Literature review		
8	Madu et al. (1996)	<i>IJPE</i>	178	Empirical	United States	Multiple
9	O'Meara & Centers (1999)		1	Viewpoint		
10	Smith et al. (2009)	<i>JOM</i>	105	Empirical	n/a	Manufacturing
11	Sohal & Egglestone (1994)	<i>IJOPM</i>	278	Empirical	Australia	Manufacturing
12	Tortorella & Fogliatto (2017)	<i>LODJ</i>	29	Empirical	Brazil	Manufacturing
13	Tortorella et al. (2017)	<i>JMTM</i>	14	Empirical	Brazil	Multiple
14	Tortorella et al. (2019)	<i>JMTM</i>	3	Empirical	Brazil	Healthcare
15	Witcher et al. (2008)	<i>IJOPM</i>	61	Empirical	South Africa	Manufacturing
<i>Backward snowballing</i>						
1	Åhlström (1998)	<i>EUMJ</i>	270	Empirical	Sweden	Manufacturing
2	Åhlström & Karlsson (2000)	<i>IJOPM</i>	47	Empirical	Sweden	Manufacturing
3	Aij et al. (2015)	<i>JHOM</i>	34	Empirical	The Netherlands	Healthcare
4	Aij & Teunissen (2017)	<i>LHS</i>	51	Literature review		
5	Akao (1991)		513	Textbook		
6	Amabile & Kramer (2011)	<i>HBR</i>	323	Viewpoint		
7	Anand et al. (2009)	<i>JOM</i>	481	Empirical	United States	Multiple
8	Anthony (1965)		5,557	Textbook		
9	Balogun & Johnson (2004)	<i>AMJ</i>	1,696	Empirical	United Kingdom	Utilities
10	Bartlett & Ghoshal (1993)	<i>SMJ</i>	930	Empirical	Multiple	Multiple
11	Benders & van Bijsterveld (2000)	<i>NTWE</i>	217	Literature review		
12	Bessant et al. (1994)	<i>TECH</i>	565	Conceptual		
13	Boer et al. (2000)		196	Textbook		
14	Boyle et al. (2011)	<i>JMTM</i>	158	Empirical	Canada	Manufacturing
15	Camuffo & Gerli (2018)	<i>IJOPM</i>	20	Empirical	Italy	Manufacturing
16	Dombrowski & Mielke (2013)		187	Literature review		
17	Dombrowski & Mielke (2014)		175	Literature review		
18	Dutton et al. (1997)	<i>SMJ</i>	815	Empirical	United States	Telecommunications
19	Emiliani (1998)	<i>MD</i>	321	Conceptual		
20	Emiliani (2003)	<i>MD</i>	321	Conceptual		
21	Emiliani (2008)	<i>LODJ</i>	110	Empirical	Multiple	Multiple

No.	Author/s (year)	Journal ^a	Citations ^b	Type	Country	Industry
22	Emiliani & Stec (2005)	<i>LODJ</i>	216	Literature review		
23	Endres (2000)		12	Textbook		
24	Floyd & Wooldridge (1994)	<i>AMP</i>	707	Viewpoint		
25	Floyd & Wooldridge (1996)		294	Textbook		
26	Floyd & Wooldridge (1997)	<i>JMS</i>	998	Empirical	n/a	Multiple
27	Floyd & Wooldridge (2000)		546	Textbook		
28	Found (2006)	<i>IJKCCM</i>	18	Empirical	United Kingdom	Manufacturing
29	Found & Harvey (2007)	<i>IETEM</i>	46	Viewpoint		
30	Hines et al. (2004)	<i>IJOPM</i>	2,296	Conceptual		
31	Hines et al. (2008)		333	Textbook		
32	House et al. (2004)		10,816	Textbook		
33	Huy (2001)	<i>HBR</i>	696	Viewpoint		
34	Huy (2002)	<i>ASQ</i>	1,339	Empirical	n/a	Information Technology
35	Kondo (1998)	<i>TTQMM</i>	90	Viewpoint		
36	Laureani & Antony (2018)	<i>TQMBE</i>	62	Empirical	Multiple	Multiple
37	Liker (2004)		7,708	Textbook		
38	Liker & Convis (2011)		403	Textbook		
39	Lodgaard et al. (2016)		39	Empirical	Norway	Manufacturing
40	Lucey et al. (2005)	<i>MS</i>	135	Viewpoint		
41	Mann (2005; 2014)		706	Textbook		
42	Mann (2009)	<i>FHSM</i>	275	Viewpoint		
43	Marodin & Saurin (2013)	<i>IJPR</i>	270	Literature review		
44	Martínez-Jurado et al. (2013)	<i>MD</i>	60	Empirical	Spain	Manufacturing
45	Martínez-Jurado & Moyano-Fuentes (2014)	<i>PPC</i>	71	Empirical	Spain	Manufacturing
46	Martyn & Crowell (2012)		3	Textbook		
47	Netland (2016)	<i>IJPR</i>	209	Empirical	Multiple	Manufacturing
48	Netland et al. (2015)	<i>JOM</i>	116	Empirical	Multiple	Manufacturing
49	Nonaka (1988)	<i>SMR</i>	969	Viewpoint		
50	Nonaka (1994)	<i>OS</i>	25,749	Conceptual		
51	Northouse (1997)		20,636	Textbook		
52	Oakland (2011)	<i>TQMBE</i>	172	Viewpoint		
53	Poksinska et al. (2013)	<i>TQMBE</i>	178	Empirical	Sweden	Multiple

No.	Author/s (year)	Journal ^a	Citations ^b	Type	Country	Industry
54	Rother (2010)		795	Textbook		
55	Schein (2010)		54,639	Textbook		
56	Seidel et al. (2019)	<i>PPC</i>	10	Literature review		
57	Shook (2010)	<i>SMR</i>	239	Viewpoint		
58	Spear (2004)	<i>HBR</i>	574	Viewpoint		
58	Spear & Bowen (1999)	<i>HBR</i>	2,090	Viewpoint		
60	Suresh et al. (2012)	<i>TTQMJ</i>	44	Conceptual		
61	Tennant & Roberts (2001a)	<i>KPM</i>	70	Empirical	United Kingdom	Manufacturing
62	Tennant & Roberts (2001b)	<i>LRP</i>	116	Empirical	United Kingdom	Manufacturing
63	Tortorella et al. (2018)	<i>IJOPM</i>	35	Empirical	Brazil	Manufacturing
64	van Dun & Wilderom (2012)	<i>IRIOP</i>	26	Literature review		
65	Westley (1990)	<i>SMJ</i>	778	Empirical	n/a	Manufacturing
66	Witcher & Butterworth (1999)	<i>LRP</i>	102	Empirical	United Kingdom	Information Technology
67	Womack (2011)		159	Textbook		
68	Womack & Jones (2003)		12,867	Textbook		

Source: Authors

Note: ^a*Academy of Management Journal (AMJ); Academy of Management Perspectives (AMP); Administrative Science Quarterly (ASQ); Business Process Management Journal (BPMJ); Engineering Management Journal (ENMJ); European Management Journal (EUMJ); Frontiers of Health Services Management (FHSM); Harvard Business Review (HBR); Health Care Management Review (HCMR); Human Relations (HR); IET Engineering Management (IETEM); International Journal of Health Care (IJHC); International Journal of Lean Six Sigma (IJLSS); International Journal of Operations & Production Management (IJOPM); International Journal of Production Economics (IJPE); International Journal of Production Research (IJPR); International Journal of Quality & Reliability Management (IJQRM); International Journal of Quality and Service Sciences (IJQSS); Journal of Health Organization and Management (JHOM); International Journal of Knowledge, Culture & Change Management (IJKCCM); International Review of Industrial and Organizational Psychology (IRIOP); Journal of Management Development (JMD); Journal of Management Studies (JMS); Journal of Manufacturing Technology Management (JMTM); Journal of Operations Management (JOM); Knowledge and Process Management (KPM); Leadership in Health Services (LHS); Leadership & Organization Development Journal (LODJ); Large Range Planning (LRP); Management Decision (MD); Management Services (MS); Managing Service Quality: An International Journal (MSQ); New Technology, Work and Employment (NTWE); Organization Science (OS); Production Planning & Control (PPC); Sloan Management Review (SMR); Strategic Management Journal (SMJ); Technovation (TECH); Total Quality Management (TQM); Total Quality Management & Business Excellence (TQMBE); The TQM Journal (TTQMJ); The TQM Magazine (TTQMM);* ^baccording to Google Scholar as of 26 August 2020

Appendix 2. Backward snowballing

No.	Backward snowballing output	Database search								Google Scholar search										<i>f</i>	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19
1	Åhlström (1998)		•																		1
2	Åhlström & Karlsson (2000)		•																		1
3	Aij et al. (2015)																		•		1
4	Aij & Teunissen (2017)																		•		1
5	Akao (1991)														•					•	2
6	Amabile & Kramer (2011)												•								1
7	Anand et al. (2009)		•																		1
8	Anthony (1965)																			•	1
9	Balogun & Johnson (2004)										•					•					2
10	Bartlett & Ghoshal (1993)	•																			1
11	Benders & van Bijsterveld (2000)		•																		1
12	Bessant et al. (1994)			•																	1
13	Boer et al. (2000)			•																	1
14	Boyle et al. (2011)																		•		1
15	Camuffo & Gerli (2018)						•														1
16	Dombrowski & Mielke (2013)		•																•		2
17	Dombrowski & Mielke (2014)						•									•	•	•			4
18	Dutton et al. (1997)										•					•					2
19	Emiliani (1998)								•										•		2
20	Emiliani (2003)	•							•			•							•		4
21	Emiliani (2008)																	•	•		2
22	Emiliani & Stec (2005)		•			•	•					•				•	•	•			7
23	Endres (2000)	•																			1
24	Floyd & Wooldridge (1994)	•	•																		2
25	Floyd & Wooldridge (1996)										•										1
26	Floyd & Wooldridge (1997)	•														•					2
27	Floyd & Wooldridge (2000)										•										1
28	Found (2006)								•												1
29	Found & Harvey (2007)											•							•		2
30	Hines et al. (2004)					•							•			•	•				4

No.	Backward snowballing output	Database search								Google Scholar search										<i>f</i>	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19
31	Hines et al. (2008)						•					•									2
32	House et al. (2004)																•	•			2
33	Huy (2001)										•	•									2
34	Huy (2002)										•	•									2
35	Kondo (1998)														•						1
36	Laureani & Antony (2018)				•														•		2
37	Liker (2004)					•	•					•					•	•	•		6
38	Liker & Convis (2011)						•		•				•				•	•	•		6
39	Lodgaard et al. (2016)						•														1
40	Lucey et al. (2005)						•		•			•									3
41	Mann (2005; 2014)					•	•							•							3
42	Mann (2009)						•		•								•	•	•		5
43	Marodin & Saurin (2013)		•						•								•	•	•		5
44	Martínez-Jurado et al. (2013)								•										•		2
45	Martínez-Jurado & Moyano-Fuentes (2014)				•																1
46	Martyn & Crowell (2012)						•														1
47	Netland (2016)						•						•								2
48	Netland et al. (2015)						•											•	•		3
49	Nonaka (1988)										•										1
50	Nonaka (1994)		•						•												2
51	Northouse (1997)								•								•	•			3
52	Oakland (2011)	•							•												2
53	Poksinska et al. (2013)		•						•				•						•		4
54	Rother (2010)						•						•				•	•			4
55	Schein (2010)								•	•			•								3
56	Seidel et al. (2019)						•														1
57	Shook (2010)																•	•	•		3
58	Spear (2004)		•				•		•									•	•		5
59	Spear & Bowen (1999)																	•	•		2
60	Suresh et al. (2012)																•	•			2
61	Tennant & Roberts (2001a)														•						1

No.	Backward snowballing output	Database search								Google Scholar search										<i>f</i>	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19
62	Tennant & Roberts (2001b)														•						1
63	Tortorella et al. (2018)																		•		1
64	van Dun & Wilderom (2012)						•		•									•	•		4
65	Westley (1990)										•										1
66	Witcher & Butterworth (1999)														•					•	2
67	Womack (2011)							•													1
68	Womack & Jones (2003)								•			•	•	•				•	•		6
	Total	6	11	2	2	4	17	1	16	1	8	8	8	3	5	3	12	18	24	3	

Source: Authors

Note: (1) Alhaqbani et al. (2016); (2) Holmemo & Ingvaldsen (2016); (3) Jørgensen et al. (2003); (4) Lleo et al. (2017); (5) Marodin & Saurin (2015); (6) Netland et al. (2019); (7) Schell & Kuntz (2013); (8) van Dun et al. (2017); (9) Bamford & Forrester (2003); (10) Camuffo & Gerli (2005); (11) Found et al. (2009); (12) Holmemo et al. (2018); (13) Holweg et al. (2018); (14) Jolayemi (2008); (15) Smith et al. (2009); (16) Tortorella & Fogliatto (2017); (17) Tortorella et al. (2017); (18) Tortorella et al. (2019); (19) Witcher et al. (2008)

Appendix 3. Supplementary information to the integrative, conceptual model of the middle management role in lean

No.	Managerial lean practices	Description	Relevant literature
1	Policy deployment (“hoshin kanri”)	Double-agency role between senior and lower management level and middle-up-down management to align strategic and operational decision-making	Nonaka (1988; 1996); Westley (1990); Floyd & Wooldridge (1996; 1997; 2000); Dutton et al. (1997); Kondo (1998); Womack & Shook (2011); Schell & Kuntz (2013); Bicheno & Holweg (2016); Holmemo & Ingvaldsen (2016); Engle et al. (2017); Tortorella et al. (2017); Holweg et al. (2018); Netland et al. (2019)
		Means deployment	Lam (1996); Kondo (1998); Bicheno & Holweg (2016); Holmemo & Ingvaldsen (2016); van Dun et al. (2017); Netland et al. (2019)
		Strategy communication	Kondo (1998); Floyd & Wooldridge (1994); Dutton et al. (1997); Harrington & Williams (2004); Netland et al. (2019)
		Review actions at lower management	Anthony (1965); Jolayemi (2008)
2	Leader standard work	Verify whether continuous improvement is taking place	Mann (2009); Tortorella et al. (2017)
		Meet accountabilities, responsibilities and standard routines (e.g. meeting structure and regular gemba walks)	Mann (2005; 2009; 2014); Liker & Convis (2011); Poksinska et al. (2013); Netland et al. (2015; 2019); Bicheno & Holweg (2016); Found & Bicheno (2016)
		Follow up task assignments	Poksinska et al. (2013)
		Maintain and improve leader standard work	Mann (2005)
3	Continuous improvement promotion	Sustained continuous improvement promotion (e.g. guidance of meaningful improvements and harness the power of small quick wins)	Spear (2004); Found (2006); Hines et al. (2008); Rother (2010); Holmemo & Ingvaldsen (2016); Netland (2016); Holweg et al. (2018)
		Continuous improvement practices (e.g. structured problem solving, teamwork, visual management, suggestion schemes, kaizen events and cross-functional communication)	Spear (2004); Found & Harvey (2007); Liker & Convis (2011); Poksinska et al. (2013); Mann (2014); Rother (2010); Netland et al. (2019)
		Culture carrier and role model	Liker (2004); Mann (2005); Hines et al. (2008); Boyle et al. (2011); Liker & Convis (2011); Poksinska et al. (2013); Laureani & Antony (2018); Holweg et al. (2018); Tortorella et al. (2019)
		Provide resources and tools	Spear (2004); Found & Harvey (2007); Liker & Convis (2011); Poksinska et al. (2013); Netland et al. (2019)
		Bottom-up involvement gateway	Bessant et al. (1994)

No.	Managerial lean practices	Description	Relevant literature
4	Self-development	Precondition to be able to coach subordinates Personal development to becoming a lean ambassador Continuous improvement of standard routines Empowerment	Poksinska et al. (2013) Anand (1996); O'Meara & Centers (1999); Poksinska et al. (2013) Mann (2005) Manville et al. (2012)
5	Coaching	Promote organisational learning and knowledge exchange Top-down coaching (i.e. train the trainer) Instil underlying lean principles and close cultural gaps Identify subordinates' training needs Provide training for subordinates' daily key activities to develop continuous improvement capabilities Encourage structured problem-solving	Mann (2005); Poksinska et al. (2013) Netland et al. (2019) Spear (2004); Rother (2010); Poksinska et al. (2013); van Dun et al. (2017); Holweg et al. (2018); Netland et al. (2019); Seidel et al. (2019) Liker & Convis (2011); Dombrowski & Mielke (2014) Mann (2009); Engle et al. (2017); Tortorella et al. (2017) Spear & Bowen (1999); Liker (2004); Spear (2004); Rother (2010); Poksinska et al. (2013); Dombrowski & Mielke (2014); van Dun et al. (2017); Holweg et al. (2018)
6	Gemba walks	Sense-making Challenge subordinates' standard work Feedback Show care with physical presence Develop understanding of value creation and non-conformance of the standard firsthand Identify waste and improvement opportunities Interact with subordinates and understand their daily challenges and concerns Recognise employees' contributions	Balogun & Johnson (2004); Huy (2011); Holweg et al. (2018) Mann (2009); Aij & Teunissen (2017) van Dun et al. (2017) Aij et al. (2015); Aij & Teunissen (2017) Spear (2004); Mann (2005; 2009); Dombrowski & Mielke (2014); Aij et al. (2015); Bicheno & Holweg (2016); van Dun et al. (2017); Camuffo & Gerli (2018); Netland et al. (2019); Seidel et al. (2019) Mann (2009); Aij & Teunissen (2017) Mann (2009); Dombrowski & Mielke (2014); Aij & Teunissen (2017); van Dun et al. (2017); Seidel et al. (2019) Aij et al. (2015); Netland et al. (2015); Aij & Teunissen (2017)

Source: Authors