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Critical success factors of Lean Six Sigma from leaders' perspective

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Abstract

Purpose – This paper aims to provide a synthesis of the results of the previous literature on leadership behaviours that enable successful Lean Six Sigma implementation.

Design/methodology/approach – The published literature that relates to leadership and Lean Six Sigma has been included. A thematic analysis was conducted on the previous literature which helped in identifying the relevant aspects and associating the behaviours with specific aspects.

Findings – After analysing the literature, seven key aspects have emerged: (1) communication; (2) culture of continuous improvement; (3) coaching and developing employees; (4) creating vision and aligning goals; (5) employee motivation; (6) employee empowerment; (7) leadership commitment and support. The main leadership behaviours that facilitate and support Lean Six Sigma implementation have been summarised.

Originality/ value – Thematic analysis in this field is scarce, so identifying the leadership behaviours' themes can help researchers in developing a framework of leadership behaviours. Organisations and practitioners of Lean Six Sigma can take into consideration these behaviours as a key to the successful implementation of Lean Six Sigma. They can adjust their behaviours and know the behaviours that need to be developed among leaders. This would facilitate the Lean Six Sigma journey by overcoming the challenges that face practitioners during Lean Six Sigma implementation.

Key words

Leadership, Behaviours, Literature review, Thematic analysis, Lean Six Sigma, Implementation.

Paper type

Review paper

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Introduction

Lean Six Sigma is widely recognised as a business strategy for deploying continuous improvement in the manufacturing, service and public sectors (Albliwi *et al.*, 2015). Lean Six Sigma integration is possible and beneficial; applying Lean and Six Sigma together bring many benefits for the organisation because these philosophies complement each other (Salah *et al.*, 2010). The main focus of Lean Six Sigma is to enhance quality and productivity of business (Singh and Rathi, 2019). The term Lean Six Sigma was introduced for the first time in the literature around 2000 (Antony *et al.*, 2012; Snee, 2010). Lean Six Sigma is "a continuous improvement methodology that aims to reduce the costs of poor quality, improve the bottom-line results and create value for both customers and shareholders" (Albliwi *et al.*, 2014, p.1012). Lean manufacturing is known as a philosophy that aims to eliminate waste within the operations process and facilitate production flow in an efficient and effective way (Alsmadi *et al.,* 2012; Papadopoulou and Özbayrak, 2005; Reichhart and Holweg, 2007). Six Sigma is defined as a tool to reduce variation in processes by depending on improvement specialists and an organised method to achieve organisational goals and increase customer satisfaction (Schroeder *et al.*, 2008).

Van Dun *et al.* (2017) identify leaders' behaviours as specific observable actions of leaders whenever they interact with subordinates within the organisational context. The literature shows that the adoption of new initiatives affects leaders' expectations as well as leadership behaviours (House *et al.*, 2004). Particular leadership attributes and behaviours might influence the success and applicability of these practices. In turn, the success of Lean Six Sigma implementation can be reinforced by specific leadership behaviours but inhibited by other behaviours (Gelei *et al.*, 2015). Leadership styles also have some behaviours that leaders should pay attention to them to achieve the successful implementation of Lean Six Sigma (Alnadi and McLaughlin, 2020). Alnadi and his colleague identified six leadership styles from the literature that facilitate the successful implementation of Lean Six Sigma. Lean manufacturing, to be successfully implemented, depends highly on people: leaders and followers. The way leaders interact and behave influences the followers (Tortorella *et al.*, 2016). The leaders' role has been changed during Lean implementation from monitor and control processes to setting objectives and satisfying customers' needs (Poksinska *et al.*, 2013).

The leaders became more visible and mainly focus on supporting employees (Poksinska *et al*., 2013).

Some studies focus on leadership characteristics, attributes, behaviours, and competencies that facilitate the use of Lean and Six Sigma (Aij and Teunissen, 2017; Laureani and Antony, 2017; Nogueira *et al*., 2018; Seidel et al., 2017; Tortorella *et al*., 2019). This study specifically identifies leadership behaviours and styles that can have an impact on the successful use of Lean Six Sigma. After reviewing the literature, the authors have identified the leadership behaviours that facilitate Lean Six Sigma process and provide understanding by analysing how leadership behaviours would support the Lean Six Sigma process.

Methodology

Textual analysis is relevant to leadership research (Insch *et al*., 1997); content analysis of leaders' behaviours that are associated with the different aspects of Lean Six Sigma implementation is also possible. However, thematic analysis was used for many reasons. Thematic analysis can provide much greater detail that can be aggregated into discernible constructs (Hartman and Conklin, 2012). Thematic analysis also help in identifying, analysing, and reporting themes within data (Braun and Clarke, 2006) as it focuses on searching for specific patterns across an entire data set (Braun and Clarke, 2006). In this paper, the data are the relevant articles. Moreover, thematic analysis was useful in summarizing the large body of data and helped in developing a thick description of the emerging themes (Braun and Clarke, 2006). Through these descriptions, this study's authors highlighted the similarities and differences between themes by defining specific behaviours for each theme (Braun and Clarke, 2006). Furthermore, the thematic analysis allows the study's authors to absorb the underlining meaning and become more familiar with data by review the same piece of data several times (Guest *et al*., 2012). The authors were able to identify numerous cross-references between the data, which makes the process of analysis more comprehensive (Alhojailan, 2012). The literature was subject to thematic analysis to identify the themes that influence the successful implementation of Lean Six Sigma and the associated behaviours for each theme. The thematic analysis provides flexibility without being tied to theory. This study gathered the published literature on leadership behaviours that enable successful Lean Six Sigma implementation. Therefore, selecting a thematic analysis is one of the most suitable approaches to conduct this study.

In order to identify papers, the review was conducted through Scopus and EBSCO databases. The following keywords (leader* OR manager*) AND ("lean" OR "Six Sigma" OR "Lean Six Sigma") were used to search and retrieve relevant papers. The authors read the abstract of papers to include papers that match with research purposes. Articles related to leadership behaviours and Lean Six Sigma were included. Further inclusion criteria are English language articles, peer-reviewed articles, theoretical and empirical studies. After collecting the relevant texts, the authors familiarised themselves with the data to identify the patterns. Then a thematic analysis was conducted to identify the key aspects of leadership behaviour to facilitate Lean Six Sigma implementation. This thematic analysis process was accomplished by using NVivo 12 software for qualitative data analysis. The unit of analysis that has been adopted is content analysis, namely words and phrases, sentences, and paragraphs. The main added value of conducting content analysis is the classification of units into categories (Insch *et al*., 1997), allowing the categories to emerge from the text (Insch *et al*., 1997). The process of analysis was in line with the phases of thematic analysis as clarified by Braun and Clarke (2006).

After identifying the relevant articles and analysing the text, the researchers assigned the words, phrases, sentences, and paragraphs into categories. The authors categorised the leadership behaviours into different key aspects through an overview analysis of leadership behaviours. The leadership behaviours were then analysed by grouping them into aspects. However, the authors grouped these behaviours into aspects only when clearly certain behaviours could be related to a specific aspect. Finally, the authors checked samples of coding to ensure the classification and categorisation were applied correctly, and to what extent the same text was coded in the same way several times.

Findings

Seven key aspects of Leadership and Lean Six Sigma have been identified, and the associated behaviours are described as follows:

Communication. Most of the papers highlighted the significance of establishing effective communication for Lean Six Sigma implementation. Many studies (e.g. Aij and Teunissen, 2017; Laureani and Antony, 2017) indicate that effective Lean leaders spend considerable time in communicating and problem-solving. Aij and Teunissen (2017) point out that effective leaders both communicate information and listen carefully to subordinates, which helps in building trust and gaining more information. Establishing two-way effective communication that enhances information flow across the organisation's hierarchy is necessary to increase the

work floor employees' understanding of the current goals and objectives (Loh *et al*., 2019). Also, it is essential to involve and engage employees in improvement programmes (Laureani and Antony, 2017; Maijala et al., 2018; Poksinska *et al*., 2013). Managers communicate with top management and other team members as a part of management practices (Hwang *et al*., 2014). Verbal and visual communication systems are necessary since they are mutually supporting tools for delivering the message that help Lean Six Sigma deployment (Laureani and Antony, 2017), whereas visual tools help in clarifying goals and providing on-time feedback on process performance (Poksinska *et al*., 2013). Daily performance management uses whiteboards and dashboards to display information using simple charts (Hung *et al*., 2015; Poksinska *et al*., 2013). Visually displaying daily progress performance is known more formally in Lean terminology as the use of a "daily management" or "daily engagement" system (Maijala *et al*., 2018). Communicating make the information available for the work floor employees (Poksinska *et al*., 2013), and informs them about what is expected from them (Loh *et al*., 2019). Leaders communicate with work floor employees through the Gemba Walk; the leaders walk along the shop floor with their employees supporting daily kaizen (Toledo *et al*., 2019). The Gemba Walk refers to visiting the work floor by leaders to help in identifying waste, solving problems, and supporting employees (Aij *et al*., 2015; Mann, 2009).

Culture of continuous improvement. Leaders pay attention to activities that support continuous improvement (Poksinska *et al*., 2013). Management that practises continuous improvement focuses on finding a better way in all circumstances, and pursues an understanding of customers' need so that goods can be customised (Loh *et al*., 2019). Lean implementation aims to create a culture of continuous improvement, where employees are empowered to drive improvements and to eliminate waste (Poksinska *et al*., 2013). Culture is perceived as a building block in organisations (Berg and Black, 2014); Lean leader must ensure that the culture is serving the organisation's objectives to achieve improvements (Aij and Teunissen, 2017). A suitable organisational culture is widely considered to be essential for Lean Six Sigma implementation (Antony and Banuelas, 2002; Cheng, 2007; Kwak and Anbari, 2006; Zu *et al*., 2010). Leaders should support continuous improvement by allocating time and resources, and be open to ideas that help in achieving improvements (Poksinska *et al*., 2013). Aij and Teunissen (2017) conducted a review of leadership attributes that leaders could use to support the culture of continuous improvement, namely: task identity, feedback, autonomy, belief in improvement, and honesty; while the main behaviours that have been discussed in the

literature that supporting continuous improvement culture, namely: learning organisation culture, followers being challenged, basic performance evaluation, and managerial versatility (Aij *et al*., 2015; Camuffo and Gerli, 2018; Monden, 2011; Toledo *et al*., 2019) The leaders work on extended assignments, with in-depth processes and people knowledge; leaders' behaviours go beyond being just coordinators of resources, and frequently rotating on assignments, their behaviours change to emphasise the importance of providing managerial versatility (Camuffo and Gerli, 2018). Another behaviour of leadership is creating and supporting the development of a learning organisation culture (Aij *et al*., 2015; Maijala *et al*., 2018). Leaders, in order to support Lean Six Sigma operations, create an environment in which mistakes are regarded as opportunities for learning; learning by seeing and doing, and being committed to lifelong learning (Aij *et al*., 2013; 2015; Goodridge *et al*., 2015; Steed, 2012). This learning environment can be effective in encouraging employees to submit new ideas, they know there will be no blame for any mistakes that occur; also leaders have the courage to acknowledge their own mistakes (Goodridge *et al*., 2015; Loh *et al*., 2019). Effective leaders help in building this culture in which all employees embrace the method of identifying errors in processes without being blamed (Aij and Teunissen, 2017; Toussaint and Berry, 2013).
Another behaviour associated with developing a culture of continuous improvement is challenging and stimulating the employees. Leaders challenge the employees to do their best that leads to stimulating them (Toledo *et al*., 2019). In turn, employees can achieve improvements that include decreasing the lead time, cost and waste, as well as increasing productivity and quality (Monden, 2011; Toledo *et al*., 2019). In order to be effective in challenging the employees, the leaders must be charismatic and supportive (Fujimoto, 1999; Monden, 2011). In advanced levels of implementing Lean Six Sigma, leaders evaluate performance processes that they are responsible for, with quick and regular feedback with other managerial levels (Camuffo and Gerli, 2018). Leaders should support and practise daily kaizen (Liker and Convis, 2011). There are two rules that leaders can use to support continuous improvement (kaizen) (Spear and Bowen, 1999; Toledo *et al*., 2019). The first means all work content, sequences, timing, and outcomes should be standardised, which makes problems easier to discover. The second rule specifies the connection among individuals for the implementation of the operations; the connection must be clear regarding sending requests and receiving a response (Spear and Bowen, 1999).

Coaching and developing employees. Training employees is essential to increase their awareness about Lean Six Sigma philosophy and tools (Assarlind *et al*., 2013; Henderson and

Evans, 2000). Widespread training in organisations has been observed as an instrument for involving the employees in improvement initiatives (Laureani and Antony, 2017). Training can take two forms; outsourced or train-the-trainer. Train-the-trainer aims to make leaders competent and skilled in leading improvement; they then can train their units and followers (Assarlind *et al*., 2013; Snee, 2010). Despite different forms of training, most successful organisations believe that training is worth the investment to achieve the effective use of Lean Six Sigma (Henderson and Evans, 2000).

To promote employees' self-development, the leaders begin to identify the competencies that employees need through conduct dialogue with the employees. The following competencies are assessed: teamwork, technical knowledge, business vision, Lean thinking, communication and results for the company (Toledo *et al*., 2019). Factors that are related to employees' development are empowerment and trust building (van Assen, 2018). Being coached means the leadership role is facilitating, supporting, and functioning. This role seems to be the dominant style for successful Lean Six Sigma implementation (Maijala *et al*., 2018). Leaders tend to be both coach and teacher who provide support for team members (Camuffo and Gerli, 2018). They also focus on individual employees' skills, experience, and ability and set challenges which enhance and encourage growth in the employee (Poksinska *et al*., 2013).

Creating vision and aligning goals. This aspect refers to Hoshin Kanri, which is a strategic planning system that is intended to be consistent with Lean (Goodridge *et al*., 2015), and through which leaders interpret and spread the organisation vision and goals to teams (Liker and Convis, 2011). Hoshin Kanri can be identified as a key strategy that aims to develop a particular coherent strategic plan (Goodridge *et al*., 2015). It is also a method of aligning goals with customer focus (Aij and Teunissen, 2017). This strategy trains the employees in strategical learning, planning and goal setting, also increasing employees' understanding of the links among practices, operational goals, and strategic goals (Toledo *et al*., 2019). Leaders from different units and departments ensure the alignment of priorities and actions horizontally and vertically (Goodridge *et al*., 2015; Tortorella *et al*., 2019). The Lean leader's role is to develop long-term strategies and goals and organise the work of employees in different teams and units (Aij and Teunissen, 2017), also, ensuring the connection between the workgroup and other units of the organisation (Emiliani, 2008).

In order to create visionary and forward-thinking in organisations, leaders explain to employees the reasons for implementing Lean Six Sigma (Loh *et al*., 2019). The leaders are

responsible for aligning and implementing the vision on the organisation's priorities and goals to be achieved by the employees (Dombrowski and Mielke, 2013; Inamizu *et al*., 2014; Toledo *et al*., 2019). Although each team has a different short-term goal, Hoshin Kanri provides a central direction for all teams to be able to align with the same strategic goal and achieve long-term goals (Aij and Teunissen, 2017).

Employee motivation. Leaders support Lean Six Sigma operations by giving recognition to employees who provide improvement ideas and actively participate in the realisation of processes enhancements (Poksinska *et al*., 2013). In some organisations, teams have to provide a certain number of ideas during a specific period (Poksinska *et al*., 2013). Laureani and Antony (2017) revealed that rewards systems play a vital role in Lean Six Sigma deployment; two sub-themes were identified, namely non-financial and financial rewards. The former relate to Lean Six Sigma deployment more than the latter (Laureani and Antony, 2017). During Gemba Walks effective Lean leaders demonstrate care and recognition by acknowledging the value of employees' work (Aij and Teunissen, 2017; Antony *et al*., 2007). Leaders show care for individuals by making regular visits, during which they can respond to employees' questions and put results on a visual metrics boards (Aij, Visse and Widdershoven, 2015). The leaders influence employees' attitudes and behaviours towards the Lean Six Sigma philosophy through recognition and positive reinforcement (Poksinska *et al*., 2013); that recognition can have many forms and attributes such as encouragement, emotional rewards, and attention and acknowledgement (Aij and Teunissen, 2017). These practices of rewards and recognition aim to increase employees' motivation and organisational commitment (Poksinska *et al*., 2013). Using the right motivation can lead to wider interest and implementation for Lean Six Sigma (Balzer *et al*., 2015). Since motivated employees do what is right to achieve the organisation's goal and vision, leaders should seek to make their employees sufficiently motivated (Loh *et al*., 2019). Lean leaders work on inspiring employees to achieve a high level of motivation (Sureeratta *et al*., 2014) and should, therefore, have the ability to increase employees' engagement. Having a good relationship with employees for keeping them motivated is crucial (Loh *et al*., 2019). Leaders can enhance their relationship with followers by conducting more informal meeting and Gemba Walks which give the leaders the opportunity to talk with employees about problem-solving techniques and to examine the process (Aij *et al*., 2015; Aij and Teunissen, 2017; Loh *et al*., 2019; Maijala *et al*., 2018).

Leaders need to have the skills to motivate, inspire, stimulate, and facilitate others' development (Aij and Teunissen, 2017) and to be aware of the need to acquire those skills

(Millward and Bryan, 2005); when leaders have these skills, individuals are more willing to make any changes necessary for Lean Six Sigma deployment (Al-Balushi *et al*., 2014). Leaders' behaviour can motivate and inspire employees to achieve a common goal, by motivating them to do their best, and acknowledging their achievements (Loh *et al*., 2019).

Employee empowerment. As the level of Lean implementation is enhanced, employees become empowered and more involved in decision making (Poksinska *et al*., 2013). First of all, these employees should be trained or coached which ensures the knowledge has been transferred to them; then they are able to be trusted and empowered to undertake an action when required (Loh *et al*., 2019; R. Jadhav *et al*., 2014). Leaders should develop their relations-oriented behaviour, as long as the maturity of Lean implementation increase, through stimulating, coaching and developing subordinates (Poksinska *et al*., 2013; Tortorella *et al*., 2019). Empowering leaders enables employees to become leaders themselves (Aij and Teunissen, 2017). Previous literature on Lean has clarified empowering leadership behaviours that include leading by example, sharing information, coaching, and showing concern for employees (Aij and Teunissen, 2017; Aij *et al*., 2015; Albrecht and Andreetta, 2011; Poksinska *et al*., 2013). Organisations should develop supporting structures and routines to enable problem-solving and improvement (Poksinska *et al*., 2013). Bortolotti *et al*., (2015) point out that high power distance inhibits employees' empowerment. Contemporary organisations tend to be more flexible and organic, which enhances their ability to be adaptable to change and to empower employees (Loh *et al*., 2019). Leaders encourage employees to provide improvement ideas and the employees then have the freedom to make decisions and take suitable actions to realise those intended improvements (Poksinska *et al*.,2013). Delegating power and decision making behaviour has been mentioned in a number of previous studies (e.g. Aij *et al*., 2015; Goodridge *et al*., 2015; Maijala *et al*., 2018). Empowering leadership increases employees' engagement that then leads to more commitment and less turnover intention (Aij and Teunissen, 2017; Albrecht and Andreetta, 2011). Supporting and encouraging workers will promote engagement, which enhances the flow of dialogue through all levels of organisations (Aij and Teunissen, 2017; Antony *et al*., 2007). The employees' engagement can help in obtaining feedback on changes, and in turn leaders recognise the way people are implementing those changes (Willis *et al*., 2016). Lean leaders pass responsibility on to the employees, so that they can manage and control daily processes, and they pass managerial tasks such as managing performance measures or conducting reviews to the employees (Aij *et al*., 2015; Poksinska *et al*., 2013). Leaders can pass responsibility and authority through two-way communication,

teamwork, and meetings (Aij and Teunissen, 2017; Drotz and Poksinska, 2014). Giving responsibility to the employees increases their sense that they are the owners of processes and tasks (Aij and Teunissen, 2017; Drotz and Poksinska, 2014; Millward and Bryan, 2005), as well as employees are still accountable to the Lean leader (Aij *et al*., 2015).

Involvement, commitment, and support. Effective leaders provide support and commitment for Lean Six Sigma implementation (Aij *et al*., 2013; Goodridge *et al*., 2015; Maijala *et al*., 2018). They also show commitment and support by being actively involved and participating in improvements initiatives (Laureani and Antony, 2017). Furthermore, leaders take responsibility for facilitating culture change that happens gradually through engaging more stakeholders in Lean programmes (Goodridge *et al*., 2015). Leaders pay attention to actions that support continuous improvement; in turn, the continuous improvement becomes a crucial part in meetings, and improvement programmes are monitored and visualised (Poksinska *et al*., 2013). Further actions and activities that are related to leadership commitment, include providing all necessary resources for success, such as adequate staffing levels, suitable training, conducting events and conferences as a tool for sharing effective practices (Poksinska *et al*., 2013), and ensuring suitable time is allocated (Laureani and Antony, 2017; Poksinska *et al*., 2013). Leaders should provide financial and manpower commitment to enable Lean to be implemented successfully (Aij *et al*., 2013; Maijala *et al*., 2018). To support continuous improvement, leaders must also acknowledge initiatives, ideas and effective participation in reaching intended improvements (Poksinska *et al*., 2013). However, leaders need to show involvement in improvement programmes through their own behaviour; for instance, leaders should present themselves as a role model and act in ways compatible with the organisation's culture and values (Poksinska *et al*., 2013). Also, they can support continuous improvement by demonstrating their willingness to embrace change (Poksinska *et al*., 2013). There are some further traits that leaders should have. For instance, they should have the characteristic of being a high performer (Maijala *et al*., 2018; Steed, 2012), and have some other qualities such as humility and openness, and ability to communicate (Maijala *et al*., 2018). Some organisations use accountability to ensure a high commitment of leadership to remove barriers to improvement programmes, in that leaders feel they are accountable to do their best to facilitate Lean Six Sigma implementation (Goodridge *et al*., 2015). The focus on employee accountability is increased as the Lean implementation progresses (Goodridge *et al*., 2015).

Table I summarises the leadership behaviours that facilitate Lean Six Sigma implementation. seven key aspects have been emerged through analysing and grouping the leadership

behaviours based on what has been published in previous studies. The authors summarise in this table the leadership behaviours that are associated with each key aspect.

Table II *the key aspects for successful implementation of Lean Six Sigma and associated behaviours for it*

	Key aspects	**Leadership behaviours**	**Supporting literature**
1.	Communication (H. van Dun and Wilderom, 2016)	Receiving and giving information that conveys ideas which help leaders to know what is happening in processes, the issues that occur, as well as obtaining suggestions. Also, employees can understand the organisation's goals.	(Bijl *et al*., 2019; H. van Dun and Wilderom, 2016; Nogueira *et al*., 2018; Seidel *et al*., 2017; Tortorella *et al*., 2019)
		Leaders communicate information and listen to employees to ensure workers understand the information and to gain more information about employees' experiences, problems, and suggestions.	(Aij and Teunissen, 2017; Gelei *et al*., 2015; Inamizu *et al*., 2014; Laureani and Antony, 2017; Loh *et al*., 2019; Maijala *et al*., 2018; Poksinska *et al*., 2013)
		Visiting the work floor (Gemba Walk) which includes three activities: going to where the value is created, looking at the process, and talking to the workers. These activities enable the leaders to be involved with people, solve the problems, and demonstrate care and recognition.	(Aij *et al*., 2015; Dombrowski and Mielke, 2013; Seidel *et al*., 2019; Tortorella *et al*., 2019)
2.	Culture of continuous improvement	Creating a learning environment: leaders considers any mistakes as opportunities for learning.	(Goodridge *et al*., 2015; Loh *et al*., 2019; Maijala *et al*., 2018; Tortorella *et al*., 2019)
		Intellectual stimulation: leaders make employees more interested in challenges that they face, and make	(Nogueira *et al*., 2018; Seidel *et al*., 2017,

		them able to think in new ways to overcome issues.	2019; Tortorella *et al*., 2019)
		Leaders take responsibility for culture change.	(Aij *et al*., 2015; van Dun *et al*., 2017; Goodridge *et al*., 2015; Maijala *et al*., 2018; Sankowska *et al*., 2014; Tortorella *et al*., 2019)
		Monitoring and evaluating tasks and processes.	(Camuffo and Gerli, 2018; van Dun *et al*., 2017; Tortorella *et al*., 2019)
		Leaders should foster and maintain a continuous improvement culture that seeks excellence and considers any mistakes as opportunities to improve. This can be achieved through leaders' behaviours that support task identity, feedback, independence, and honesty.	(Aij and Teunissen, 2017), (Dombrowski and Mielke, 2013), (Toledo *et al*., 2019), (Maijala *et al*., 2018), (Goodridge *et al*., 2015), (Mann, 2009)
		Supporting continuous improvement (kaizen): all work content, sequence, timing, and outcome should be standardised, which makes discovering problem easy. Connection among employees for the implementation of the processes; the connection must be clear to send requests and receive a response.	(Loh *et al*., 2019; Seidel *et al*., 2019; Spear and Bowen, 1999; Toledo *et al*., 2019)
3.	Coaching and developing employees	Developing and training employees: using training as an instrument for engaging the employees in improvement initiatives. This training focuses on technical knowledge, Lean	(Laureani and Antony, 2017; Nogueira *et al*., 2018; Tortorella *et al*., 2019)

		thinking, Lean tools and techniques, and Lean principles. Promoting employees' self-development: creating plans and structures to support employees' development. Focusing on specific competencies to develop the employees such as technical knowledge, communication, and teamwork. Leaders develop and coach employees to support organisation goals.	(Seidel *et al*., 2017; Toledo *et al*., 2019; Tortorella *et al*., 2019) (Loh *et al*., 2019; Maijala *et al*., 2018; Poksinska *et al*., 2013; Seidel *et al*., 2017; Toledo *et al*., 2019)
4.	Creating vision and aligning goals	Formulating and communicating goals and objectives to ensure the alignment of priorities and actions that focused on customers' needs.	(Goodridge *et al*., 2015; Nogueira *et al*., 2018; Seidel *et al*.,2017; Toledo *et al*., 2019; Tortorella *et al*., 2019)
5.	Employee motivation	Leaders motivate employees who have contributed to the fulfilment of current goals, through recognition, encouragement, and having a good relationship. Also, they can use financial and non-financial rewards, presence, visibility, paying attention to, and acknowledgment for motivating employees. Leaders need skills to motivate others.	(Aij and Teunissen, 2017; Laureani and Antony, 2017; Loh *et al*., 2019; Seidel *et al*., 2019; Tortorella *et al*., 2019) (Aij and Teunissen, 2017; Laureani and Antony, 2017)
6.	Employee empowerment	Empowering employees through encouraging them to solve problems and improve their workplace. Giving the employees more responsibility for managing and controlling daily operations, to realise improvements. Giving the employees authority to both take decisions and suitable actions. Delegating decision making, power, and responsibility.	(Aij *et al*., 2015; Aij and Teunissen, 2017; Loh *et al*., 2019; Maijala *et al*., 2018; Poksinska *et al*., 2013; Seidel *et al*., 2019; Tortorella *et al*., 2019)

		Developing a supporting structure that responds to Lean initiatives such as addressing problems and improvement activities.	(Mann, 2009; Poksinska *et al*., 2013)
7.	Leadership commitment and support	Leaders demonstrating commitment and support for Lean implementation, and they feel they are accountable to do their best.	(Tortorella *et al*., 2019), (Goodridge *et al*., 2015), (Mann, 2009)

Discussion

This thematic analysis of the published literature attempts to look at leadership behaviours in some form of structure. The main leadership behaviours that emerged from the analysis were grouped and categorised under key aspects. These behaviours have then been discussed and clarified in detail. Most of these studies focused on Lean manufacturing, while a few of them focused on Six Sigma and Lean Six Sigma. This study reviews the published literatures which help in emerging comprehensive aspects. The findings replicate and expand the findings on leadership aspects through focusing specifically on identifying the relevant behaviours. This paper also provide an understanding of and analyses how leadership behaviours would support the Lean Six Sigma process, which will help in developing a framework about leadership behaviours that facilitate Lean Six Sigma.

This paper reveals a complexity in the different leadership behaviours that enable Lean Six Sigma. Although the authors have categorised each behaviour into a specific aspect, some behaviours appear across aspects. Moreover, while specific behaviours might seem similar, their effects can differ significantly.

To illustrate that, the Gemba Walk is a behaviour that supports continuous improvement. Also, it helps in coaching and developing employees. Further, the Gemba Walk helps in motivating employees through demonstrating care and recognition; it has a positive effect on developing and maintaining relationships (Poksinska *et al*., 2013). The Gemba Walk also extends to the employees' empowerment aspect; during this Walk all the people are together and, in turn, they are in a position to rapidly take suitable decisions and starting implementing them (Aij *et al*., 2015). From this evidence it is clear that the Gemba Walk behaviour affects and is related to most of the aspects, namely communication, continuous improvement, coaching and developing employees, motivating employees (Aij *et al*., 2015; Dombrowski and Mielke, 2013; Poksinska *et al*., 2013; Seidel *et al*., 2019; Tortorella *et al*., 2019). The Gemba Walk, therefore, is one of the key behaviours for Lean Six Sigma implementation. However, some behaviours

do not appear across all the emerged aspects; for example, delegating decision making, power, and responsibility are related mainly to the employee empowerment aspect.

Although previous studies (e.g. Dombrowski *et al*., 2014; Laureani and Antony, 2017; van Dun *et al*., 2017) identified some leadership behaviours and attributes that enable Lean Six Sigma operations, none of these studies investigated whether these behaviours may change with regard to the implementation of a specific set of Lean Six Sigma practices (Tortorella *et al*., 2018).

It is important to note that the Lean Six Sigma literature almost unanimously considers the seven key aspects that emerged in this study as the fundamental aspects for Lean Six Sigma implementation. The authors found that many studies, e.g. (Dombrowski and Mielke, 2013; Goodridge *et al*., 2015; Nogueira *et al*., 2018; Poksinska *et al*., 2013; Seidel *et al*., 2017, 2019; Toledo *et al*., 2019; Tortorella *et al*., 2019) relied on and grounded in previous studies' frames or models in order to identify the leadership traits that would facilitate Lean Six Sigma. One of the key studies that forms part of the literature is that of Liker (2004) who identified 14 principles of the Toyota (Lean) management system. While some studies e.g. Dombrowski and Mielke (2013) used Liker's 4P model to derive five basic principles of Lean leadership. These principles are improvement culture, self-development, qualification, Gemba, and Hoshin Kanri (Dombrowski and Mielke, 2013). The 4P model names four relevant aspects of Lean: philosophy, process, people and partners, and problem-solving (Liker, 2004). Another main study is that of Liker and Convis (2011) who identified the main characteristics of Toyota (Lean) leadership as: 1) be committed to self-development, 2) coach and develop others, 3) support daily kaizen, and 4) create vision and align goals. Furthermore, Poksinska *et al*., (2013) study is grounded on (Yukl, 1997) study that developed four managerial processes: 1) developing and maintaining relationships, 2) obtaining and giving information, 3) making decisions, and 4) influencing people, whereby these key studies were as a tool for being familiar about leadership aspects and behaviours for successful use of Lean Six Sigma. In other words, previous literature, e.g. (Liker and Convis, 2011; Liker, 2004; Womack and Jones, 2003; Womack *et al*., 1990) indicate the importance of a Lean leadership; these studies were used as the grounding for the previous studies. Also, there was found to be overlapping between these behaviours, attributes and skills.

However, this study analyses the literature without focusing on a specific study. New themes have emerged from this analysis that emphasise leadership behaviours specifically. The results

show that the organisation should have the vision to use Lean Six Sigma, then they can align the goals that help in achieving this vison. Communication can be considered as an essential background to enable other aspects to work effectively. In addition, the leader should build a culture of continuous improvement and coach and develop the employees. To sustain a Lean Six Sigma operation, top management should demonstrate commitment and support. Also, motivating the employees is necessary to increase their commitment, which in turn helps in achieving progress in Lean Six Sigma implementation. After achieving progress which means the employees are both aware and competent, the leader can empower the employees with decision making and taking responsibility.

These inductive processes present the literatures in a structured way, which could be useful for theoretical implications. Having these themes might be useful; researchers who seek to develop a framework can compare these evolved aspects with themes from field study. Researchers can compare themes identified in this study with themes form field study and rely on these themes to construct a comprehensive framework. To build a comprehensive theory about Lean Six Sigma leadership, researchers need three constructs, namely attributes, behaviours, and context. This paper can help researchers build theory about Lean Six Sigma leadership. Some factors may influence these behaviours, such as context, industry type or countries either developed or developing. Further empirical work can explore the interdependencies between these behaviours; since certain behaviours impact others such as Gemba Walk effect on other behaviours.

Practical implications

This study has significant practical implications on many aspects. First of all, identifying these behaviours will enable leaders to determine the required behaviours for successful Lean Six Sigma implementation. In other words, leaders can understand what they should do and how they should behave. Leaders should adopt these behaviours and activities to maintain successful implementation. Furthermore, the identified list of behaviours influences how leaders act to support Lean Six Sigma. This description of how leaders should act is useful for leaders since they are responsible for the success of Lean Six Sigma practices and achieve operations efficiency.

Moreover, organisations can assess the leaders' behaviours through this list of behaviours; in turn, organisations can know if they have the right leadership. Further, the results highlight that organisations can develop and promote leaders' training programs based on identified

behaviours in this study. Organisations also can stimulate suitable leadership practices for Lean Six Sigma implementation; this influence on leaders' behaviours could take time since behavioural change consumes time. Identifying, developing, and stimulating appropriate leadership behaviours support Lean Six Sigma implementation and prevent difficulties in sustaining Lean Six Sigma practices. By developing leaders' behaviours, leaders will be more effective in the Lean Six Sigma implementation journey, and the success rate for these practices can be increased.

Conclusion

The investigation concentrated upon published literature relating to leadership and Lean Six Sigma. A thematic analysis was conducted on the previous literature which helped in identifying the relevant aspects and associating the behaviours with specific aspects. This research highlights and investigates leadership's role since leadership identified as one of the critical success factors for Lean Six Sigma implementation (Laureani and Antony, 2018). Therefore, this study focused on the leadership behaviours that enable that implementation. The authors of this study conducted a thematic analysis of the published literature. Seven main aspects have emerged namely: communication; culture of continuous improvement; coaching and developing employees; creating vision and aligning goals; employee motivation; employee empowerment; leadership commitment and support. The associated behaviours have been explained how they would facilitate Lean Six Sigma implementation.

This study has some limitations. Firstly, this study relies only on literature that is not supported by a field study. Secondly, the search was only in English literature limited to Scopus and EBSCO databases. Thirdly, it did not provide differentiation between sectors such as the service and manufacturing sectors. Finally, this study focus on one of the critical success factors for Lean Six Sigma implementation; other success factors should be considered, such as culture.

Future research must further investigate traits since this study provided a high concentration on behaviours only. Further work also can review the critical success factors from other perspectives, such as culture, since leadership is just one of the critical success factors for Lean Six Sigma.

Future work can pick a sector and conduct some empirical data gathering and then doing a comparison and contrast with the literature. Future studies could also blend primary data from operating business with existing literature to identify the gaps and leadership characteristics

appropriate to Lean Six Sigma implementation. It is possible to use a survey to know the most significant behaviours for each management level for Lean Six Sigma implementation through the identified leadership behaviours. The importance and existence of these behaviours may vary regarding for managerial levels.

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Critical success factors of Lean Six Sigma from leaders' perspective

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