

Leadership that Facilitate the Successful Implementation of Lean Six Sigma

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ABSTRACT

Researchers have identified leadership as a critical success factor for Lean Six Sigma implementation. It is essential to understand leadership behaviours that facilitate the use of Lean Six Sigma. This paper aims to identify leadership styles from the literature that can facilitate Lean Six Sigma implementation, which in turn broaden the current understanding of the suitable leadership styles. Also, the authors aim to explore how leadership styles can enhance Lean Six Sigma operations. The authors systematically reviewed the literature on leadership styles and Lean Six Sigma. The results determined the leadership styles that can enable the use of Lean Six Sigma successfully. These leadership styles are as follows: situational (task-oriented or relation-oriented behaviour), transformational, servant, authentic, empowering, and distributed leadership. The authors provide a better understanding for practitioners and researchers from existing literature on how leaders' behaviours can enhance Lean Six Sigma implementation. It is not clear which style is the most dominant and effective. There is a lack in interpreting how these leadership styles linked to Lean Six Sigma implementation. There is a lack of empirical evidence most of the studies depended on a theoretical base. Very few studies have focused on leadership styles and Six Sigma success; to the best of the authors' knowledge only one paper has studied this. Also, there is scarcity in papers that addressed leadership styles that facilitate Lean Six Sigma implementation. This paper initiates a call to study Lean Six Sigma rather than focus only on either Lean or Six Sigma. This proposition guides future research based on the view that Lean management can share underlying assumptions with Lean Six Sigma characteristics. However, the main limitation of this review is the use of specific keywords and database to identify studies.

Keywords

Leadership styles; Lean Six Sigma; Lean manufacturing and Six Sigma.

1. INTRODUCTION

Lean Six Sigma is recognised as a well-known strategy for organisations to improve quality and reduce cost and time by focusing on improving the process [1]. The benefits of implementing Lean Six Sigma are increasing customer satisfaction, profits, incomes, quality and production capacity; reducing time, cost, defects, and inventory; and improving vital performance metrics [2].

Indeed, this integration between Lean manufacturing and Six Sigma emerged to ensure high quality, speed, decreased cost and reduced defects, which in turn increase customer satisfaction [3,4]. Moreover, these authors point out that this integration focuses on removing waste by applying Lean and identify the variation in the production process through Six Sigma. This integration helps an

organization to achieve better performance than applying each one in isolation [5]. Thus, it is better when researchers study leadership styles to take into consideration the integration between Lean and Six Sigma. Lean Six Sigma has a clear influence on organization performance [6]. Six Sigma reduces variation, which in turn improve productivity, Lean focus in eliminating waste and process design, which in turn improve productivity [7]. However, a wide variety of factors are influencing productivity; these factors are interrelated and interconnected, it relates to management factors, technological advancement [8], wages [9], working conditions [10], leadership and innovation [11], emotional intelligent [12,13], and labor competences and skills [14].

It is common companies facing difficulties to implement Lean Six Sigma effectively [15]. Many researchers point out many organizations fail to get benefits from continues improvement programs such as Lean and Six Sigma, as well as other organizations, fail to achieve necessary results from Lean Six Sigma; however, some organizations have successes in deploying Lean Six Sigma [16]. One of the main reasons for Lean Six Sigma failure is lack of management support not only regarding for top management level but also leadership at all levels [17]. Also, lack of management commitment and lack of strong leaders to drive initiative are one of the failure factors [18]. Researchers demonstrated that the weak management in some companies is a cause to failure because these companies do not focus on the soft sides such as leadership, culture, and employees training [18].

The most important factors for Lean Six Sigma implementation are management engagement and leadership. Lande and his colleagues point out the importance of understanding and using these factors to speed up the implementation of Lean Six Sigma [19]. However, since leadership has been identified as a success factor for Lean Six Sigma [5], many studies have begun focusing on leadership and Lean Six Sigma together. Some of these studies focus on leadership characteristics, attributes, behaviours, and competencies that facilitate the use of Lean and Six Sigma [16,20,21,22,23]. A question appeared about different leadership styles and traits that could have an effective impact on Lean Six Sigma deployment [20]. Being aware of these leadership styles can help organizations in designing effective transformation to Lean Six Sigma [24]. In turn, organizations that are going to embrace Lean Six Sigma can stimulate suitable leadership behaviours as well as develop programs for leadership.

Between the 1950s and 1960s, researchers began to focus on identifying effective leadership styles [25], and the way that leaders' behaviour can influence the performance and satisfaction of subordinates [26]. Leaders have different visions and values about managing their team to achieve organizational goals [24]. Different perspectives have emerged on relationships between leaders and followers [27]. In order to give the reader a general

understanding of the different leadership styles identified in relation to Lean Six Sigma, the authors decided to clarify these styles briefly.

This paper identifies leadership styles that support and enhance Lean Six Sigma implementation. The authors try to provide an understanding of how these styles leverage the implementation. After reviewing the literature, the authors identified six styles and clarified how these styles could support the use of Lean Six Sigma.

2. BACKGROUND INFORMATION

Lean Six Sigma evolved through Lean manufacturing production system integration with Six Sigma improvement approach [28]. Lean manufacturing is known as philosophy aims to eliminate waste for operations process and facilitate production flow in an efficient and effective way [29]. These wastes are defects, overproduction, waiting, transportation, inventory, over-processing, and unnecessary motions [30]. Six Sigma defined as a tool to reduce variation in process through depending on improvement specialists and an organized method to achieve organization goals and increase customer satisfaction [31].

Lean has four bundles that are fundamental of lean practices, namely Just-in-Time (JIT), total quality management (TQM), total preventive maintenance (TPM), and Human resource management (HRM) [32]. These bundles are inter-related practices that form the essence of Lean production; these bundles of Lean practices positively influence operation performance [32]. However, there are two aims for Six Sigma. Firstly, the reason for developing Six Sigma is to improve quality of the products by reducing the number of defects products [33]. Applying Six Sigma improve quality on a company, through the object to reach less than 3.4 defects per million opportunity (DPMO) [34]. Secondly, according to Su and Chou [35] Six Sigma is a methodology to recognize where the variation in the process happened and remove this variation in order to create value for customer and in turn increase customer satisfaction.

Despite seeing Six Sigma as technical approach to process control, it should be taken into consideration the wider philosophy behind the technical and statistical side of Six Sigma, thus, organization should take care to manage people properly, or training new employees [36]. Six Sigma including two methodologies: DMAIC (define, measure, analyse, improve, and control) and DMADV (define, measure, analyse, design and verify). DMAIC methodology is used to improve the existing process, while DMADV is used for developing new processes and products [37,38].

Leadership defined as “the ability of an individual to influence, motivate and enable others to contribute toward the effectiveness and success of the organisations of which they are members” [39:494]. Researchers have developed several leadership theories to address different aspects related to leadership and explain these aspects from different points of view in different periods [40]. The intensive studies for leadership contribute to developing different perspectives of leadership. Different researchers have different conceptualisation about leadership. Some of them observe or conceptualize leadership as traits or as behaviours, whereas others observe leadership from an information-processing viewpoint or relational perspective [41]. The behavioural perspective has emerged after the traits theory, in the 1950s, researchers began emphasising on behaviours; what leaders do and how these behaviours influence followers and predict effectiveness [42]. Leadership behaviour is what leaders do and how they act [26].

The underlying assumption of *situational leadership* is that there is no single best style of leadership. Leadership behaviour depends on the situation and maturity of the followers, and changes according to the situation [43]. In this way, leader behaviours would be task-oriented or relation-oriented. *Transformational leadership* describes a leader who influences followers to achieve an organisation’s vision and initiates the change through inspiration, and conducts the change through team members commitment [44]. Bass suggested that transformational leadership behaviours are consist of four factors that primary for influencing followers, namely: idealized influence (charismatic influence), inspirational motivation, intellectual stimulation, and individualized consideration [45]. *Transactional leadership* is leaders who set clear objectives for followers and use either rewards or punishments in order to stimulate followers to achieve these goals [46]. *Servant leaders* see employees as equals rather than followers [47]. Servant leaders are concerned with prioritising followers’ needs. Servant leaders are responsible for supporting and coaching employees [48], in order to optimise their performance. Servant leaders’ characteristics are listening, empathy, healing (to overcoming personal problems), awareness, persuasion, conceptualization, foresight (predicting the future), stewardship, commitment to the growth of people, and building community [49]. While, servant leadership behaviours are empowering, prioritising and developing followers, behaving ethically, emotional healing, and creating value for community [50,51,52]. *Authentic leadership* is a leadership style in which leaders are aware of their behaviours that makes followers perceive leaders as trustworthy and believable [53,54]. Authentic leaders are true to themselves and depend on internal values and standards, rather than respond to external pressures [55]. Authentic leadership has five important features and characteristics, namely: leaders have a sense of purpose, they have strong values about how to act, they establish trusting relationships, they have self-discipline and act on their values, and they show empathy to the status of others [56]. *Empowering leadership* focuses on increasing employees empowerment which refers to individuals becoming able to define their work roles, achieve meaningful work, and affect significant events [57]. Empowering leadership can be observed from different perspectives. The first perspective, power-sharing refers to authority and responsibility that leaders award to followers. The second perspective is related to psychological issue that concern in removing the feeling of helplessness and increase employee motivation [58]. *Distributed leadership* involves multiple leaders with different but interrelated tasks, and both informal and formal may be involved [57]. Distributed leadership increase the power of all the employees and spread it among organisation members, rather than focussed on a single formal leader [59,60]. The characteristic of distributed leadership is that it reduces the power of the solo leader, and enabling members to take a leadership role [61]. Distributed leadership to be truly successful; focus on leadership as *a practice* rather than leadership as role or responsibility [62].

3. METHODOLOGY

This study is based on a systematic review of the literature. Authors review the studies that identified leadership styles that contribute to Lean Six Sigma process success. Keywords were differentiated to find the most related papers. Also, the authors used cross-referencing between papers in order to reduce search bias and widespread results. For the initial search, the syntax was “leader*” OR “manage*” AND “Lean” or “Six Sigma”. Initial search identified 3277 documents. Then, 159 potential papers were identified by limiting the search to paper titles. Another way used by authors to search was by identifying different keywords which

were “leader*” AND (behaviour* OR behaviour* OR aspect* OR practice* OR attribute* OR trait* OR characteristic*). This search approach generated 179 papers. The researchers relied on Scopus database to conduct this review.

In order to determine if the paper is relevant to the study aim, the abstract, results and conclusion were read by the authors. Then the inclusion criteria were applied. The inclusion criteria for this research were English-language articles that could be an empirical study or a theoretical study. No restriction was placed on the year of publication. Also, we embedded the papers that match the review aim. By using this procedure, only 17 papers were identified as related to this study that met the inclusion criteria.

4. RESULTS

After reviewing the identified papers, six main leadership styles were identified from the literature. These studies have tried to link leadership styles and Lean Six Sigma empirically and/or theoretically. The authors identified corresponding leadership styles that were mentioned in previous studies of leadership literature, see table 1.

Table 1 leadership styles that facilitate Lean Six Sigma implementation

Leadership styles	Supporting literature
Situational (task-oriented, relation-oriented behaviours)	[23], [63], [24], [64], [65], [66], [67]
Transformational leadership	[63], [68], [65], [69], [70], [71]
Servant leadership	[63], [68], [72], [73]
Authentic leadership	[63], [55]
Empowering leadership	[21], [68], [74], [75], [29]
Distributed leadership (Team leadership)	[63], [70]

The following paragraphs are provided clarification for the impact of those leadership styles on Lean Six Sigma implementation success. The organisations are thinking about using Lean Six Sigma, can pay attention to the behaviours and attitudes of the leaders associated to these styles.

Relation-oriented behaviour is about time spent in solving-issues and communication referred to some studies as effective lean leaders behaviours [76,77]. This relation-oriented behaviour helps in establishing a culture of continuous improvement [78,79]. Nevertheless, relation-oriented behaviours are negatively associated with Lean bundles such as JIT, in contrast to task-oriented behaviour, which is associated positively with Lean [24].

Highly relation-oriented behaviour may not be effective, as leaders in this style tend to delegate and facilitate tasks, which is dependent on the maturity of their followers [24]. This behaviour should be the last to be applied in Lean Management implementation journey [80,81]. Some researchers supported this view that leaders should develop their relations-oriented behaviour, as long as the maturity of Lean implementation increased, through stimulating, coaching and developing subordinates [73,23]. Then daily activities of

management can be passed gradually to subordinates to shift toward a self-managed team, achieved through empowering and involving employees in improvement activities [73].

Task-oriented behaviour has been discussed in the literature related to Lean. Tortorella and his colleagues found that task-oriented behaviour is more helpful in achieving higher levels of implementing Lean Management than relation-oriented behaviours [24]. This result is to some extent in line with previous indications [82]. The intensive using of task-oriented behaviour and relation-oriented behaviour for implementing Lean is vary according to hierarchical level [66].

In the case of Lean manufacturing, the contextual relating to the behavioural orientation of leaders, do matter [66]. Tortorella and his colleagues pointed out the number of followers as a contextual variable that must be observed by senior chiefs and executives. Another study focused on team size and leader’s age, and showed that bigger teams and more ranking managers were negatively connected with Lean manufacturing implementation [24]. Furthermore, Tortorella and Fogliatto (2017, p.946) stated that “The method points at improvement alternatives that may be developed simultaneously at different leadership hierarchical levels in companies”. In other words, their method identified situational leadership style in term of task-oriented behaviour or relation-oriented behaviour that most contribute to each implementation phase of Lean management roadmap, according to the hierarchical position of the leaders. This model helps in identifying the relationships between multi-level leadership styles and the implementation phases of the Lean roadmap [67].

Pokinska and his colleagues suggested that many of the leadership practices and behaviours displayed by Lean leaders can be categorised as transformational leadership [65]. Indeed, in literature, there has been a connection made between transformational leadership style and Lean leadership [68,55,79]. Moreover, Reiner points out that transformational leadership support Lean implementation in organisations since this style creates more proactive employees [83].

Transformational leadership characteristics emphasised stimulation, empowerment, communication, persuasion, and teaching [84]. These individual characteristics are connected to the using of Lean, whereas teaching workers about identifying and solving problems, and empowering followers to implement their ideas, is considered as a supporter to Lean systems [77,63].

The key idea of this leadership style is that servant leaders focus on responding to followers’ needs. Servant leaders must provide resources for followers to facilitate their work to add-value to the end customers [63]. This is important to Lean, which considers that the main adding-value activity is accomplished at the front-line [79]. Indeed, there is a positive connection between Lean leadership and servant leadership, since Lean and servant leadership share underlying principles [73]. Van Assen refutes this, highlighting a negative connection between servant leadership and the use of Lean tools, and arguing that servant leadership is not related to the occurrence of a continuous improvement culture [68].

Aij and Rapsaniotis reviewed the literature and found significant similarities and intersections between Lean leadership and servant leadership, while they observe differences in origins, philosophy, characteristics and behaviours, and tools [72]. This overlap between Lean and servant leadership can broaden leaders’ understanding on how to inspire high performance and contribute to the successful Lean operations [72].

According to Seidel and his colleagues, this authentic leadership style is relevant to Lean, “in particular, at the influence process dimension since lean involves changes in work practises that demand persistence and practical demonstration of know-how of the leader” [63:1328]. Swain and his colleagues conducted a study to understand the way authentic leaders and leaders with behavioural integrity can facilitate the Six Sigma processes[55]. They point out that to get the best benefit of Six Sigma in organizations, both authentic leadership and behavioural integrity are required. Leaders should have a commitment to the values they adopt. Combining authentic leaders and behavioural integrity can support raised levels of Six Sigma performance in the work environment. Also, combining these qualities for Six Sigma can help organizations to gain competitive advantage [55].

Sharing information and knowledge with subordinates enables empowerment which in turn allows employees to participate in decision making and contribute to organizational performance [85]. Empowerment behaviour of leadership is an important behaviour for stimulating employees to use Lean tools [74].

One of the central aspects of the Toyota Production System TPS is workplace learning [75]. They found that empowering leadership facilitates learning in TPS context. There is a positive correlation between empowered leadership style and the use of Lean tools [68]. Nogueira and his colleagues confirm this result by finding that an empowering leadership style positively influences Lean management implementation [21].

The relationship between distribution leadership and Lean Six Sigma has been researched theoretically and empirically, see [70,63]. This leadership style seems to promote employees participation and stimulating them to use their capabilities. In turn, this authorization is critical for empowering shop floor employees in organisations that apply Lean management [86]. Team leadership increase employees’ involvement and enhance the bottom-up, which help in create a culture of identifying waste, suggesting improvements and applying solutions [70]. In order to use Lean manufacturing effectively in organisations, all employees need to identify where improvements can be made, and they should take responsibility for implementing solutions [87]. Leaders can increase employees’ enthusiasm for identifying waste and suggesting improvements by engaging them in all the processes of the organization [86]. Authorising and empowering employees is essential since they are more involved in details of the work; they are more aware into what need improvements [88,70].

The previous literature established link between distributed Leadership and Lean Six Sigma implementation [70,63]. Whereas, distributed Leadership relevant for lean leadership, since distributed Leadership can give a better understanding of how lean leadership occurs as a interaction between leaders and team members [63]. Distributed Leadership is one of the factors that enable the successful transition from the theoretical approach of implementing lean tools to the actual transformation to Lean management [70].

5. DISCUSSION

The purpose of this systematic literature review was to provide insight into the studies that investigated leadership styles that facilitate Lean Six Sigma implementation. The authors identified corresponding leadership styles that were mentioned in previous studies of leadership literature.

The authors provide a better understanding for practitioners and researchers on how leaders’ behaviours can enhance Lean Six

Sigma implementation. First of all, relation-oriented behaviour helps in creating a culture of continues improvement that use Lean Six Sigma as a tool to achieve continues improvement. Adopting task or relation behaviours vary according to Lean implementation phase and hierarchal levels. Furthermore, transformational leadership enable Lean Six Sigma implementation since this style creates more proactive employees. The individual characteristics for leaders in this style such as stimulating, empowerment, persuasion and teaching are related to Lean implementation, whereas teaching workers about identifying and solving problems, and empowering followers to implement their ideas; supporting Lean implementation. Servant leadership provides the necessary resources for employees to enable their work to add value to the end customers. Authentic leadership shows commitment to the values leaders adopted; this commitment is vital to Lean Six Sigma implementation. Distributed leadership relevant to Lean manufacturing, since leaders supposed to receive feedback from followers and those leaders should improve their performance continuously. This style emerges as a result of having followers who are aware of using and of the importance of Lean process [63].

The authors observed that researchers mainly focused on situational leadership style (task-oriented and relation-oriented behaviours) in investigating Lean Six Sigma. Several studies conclude that task-oriented behaviour is more effective than relation-oriented behaviour in early stages of Lean Six Sigma deployment [24]. Also, contextual variables are considered as a factor affecting leader behavioural orientation and Lean implementation whereas the big team size inhibit Lean implementation effectively. The importance of studying contextual variables that relate to leadership style is to plan and design the organisational structure (size of teams and hierarchy levels) to fit with desired outcomes for Lean implementation [66]. Also, it helps in developing programs for leadership development to fulfil the Lean implementation phase requirement and to stimulate the suitable behaviours of leaders.

Transformational leadership is a supportive style, since leaders show concern and recognition to individual needs [89]. Creating a vision for followers which can improve their understanding of the significance and qualities related with desired results, transformational leadership increase followers performance and raise their readiness to work towards a common goal [90]. This style increase followers commitment and motivation to achieve long-term goals and leaders’ visions [91].

There is a contrast between studies that studied servant leadership. Some of these studies found a positive connection in using this style and Lean e.g. [65] while other studies disprove this e.g. [89]. This divergence indicates this style may be less effective than other styles for facilitating Lean Six Sigma implementation.

Authentic leadership focuses on developing leaders behaviours to be trustworthiness and believable, whereas leaders should learn to develop these behaviours and qualities [77,61]. This might be intersected with Lean leadership that has an emphasis on self-development, which is mentioned as the first step to leadership development at Toyota [77]. Researchers studied the authentic style that is necessary for both Lean and Six Sigma, but they did not study the relationship between authentic style and Lean Six Sigma.

The importance of studying contextual variables that relate to leadership style is to plan and design the organisational structure (size of teams and hierarchy levels) to fit with desired outcomes for Lean implementation [66]. Also, it helps in developing programs

for leadership development to fulfil the Lean implementation phase requirement and to stimulate the suitable behaviours of leaders.

This variety in leadership behaviours may indicate that there is not a single leadership style to implement Lean Six Sigma successfully [73]. However, effective leadership show a balanced set of multiple styles [92]. This indicates to the possibility to studying leadership beyond specific lenses, in that researchers can conduct studies to build new perspective and theory about the suitable attributes for Lean Six Sigma. However, the authors of this paper argue these styles overlap in creating commitment and motivating employees for Lean Six Sigma.

6. CONCLUSION AND FURTHER RESEARCH

This work contributes to creating a new understanding of available literature about Lean Six Sigma and leadership. Six leadership styles were found, namely situational (task-oriented or relation-oriented behaviour), transformational, servant, authentic, empowering, and distributed leadership. The discussion section highlighted how these styles facilitate Lean Six Sigma implementation. The authors found overlap between the leadership styles and Lean, although there were notable differences in effectiveness and some styles have a negative impact. However, leaders and practitioners can adopt styles and behaviours that suitable to organisation context.

This paper identified research gaps in this context. Few studies have examined the relationship between Lean manufacturing and leadership styles. To the best of the authors' knowledge, only one study focused on Six Sigma, while no study has investigated Lean Six Sigma together. Neglecting Lean Six Sigma might create a knowledge gap that researchers should fill. Researchers should focus more on Six Sigma and make comparison with Lean. Also, they should study Lean Six Sigma together since these tools have been integrated since the 2000s. Although there is considerable attention on Lean, the extent to which leadership styles are relevant to Lean Six Sigma has not yet been properly investigated. Some researchers have neglected studying Lean Six Sigma, while others have started studying Lean Six Sigma with other factors as mentioned previously. This encourages the researchers to take a further step in studying Lean Six Sigma

However, there is a lack of empirical evidence most of the studies depend on theoretical base. Therefore, there is a need to conduct more empirical studies in this area. We encourage researchers to focus on Lean Six Sigma rather than just Lean or Six Sigma in isolation. Further research can go beyond these styles to investigate other leadership styles such as ethical leadership, and strategic leadership. These styles are probably linked to Lean Six Sigma.

The authors suggest to modelling what the leadership styles look like in different settings and to evaluate their impact on operational performance and other metrics. Also, researchers can determine contextual variables that affect leaders and followers relationship. There is a need to link leadership to the contextual factors that might influence Lean Six Sigma operations. In turn, researchers can identify the desirable and undesirable contexts for enabling or inhibit Lean Six Sigma operation. Future study can focus on comparing between these styles in order to identify the dominant leadership style. Researchers can conduct a study to identify differences in leadership styles at different hierarchical levels and industries. This paper initiates a call to study Lean Six Sigma rather than focus only on either Lean manufacturing or Six Sigma. This proposition guides future research based on the view that Lean

manufacturing can share underlying assumptions with Lean Six Sigma characteristics. Limitation of this review is the use of specific keywords to identify studies; other researchers can use different search strategies and databases that would generate new results.

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8. REFERENCES

- [1] M. Kumar, J. Antony, R. K. Singh, M. K. Tiwari, and D. Perry. 2006. Implementing the lean sigma framework in an Indian SME: A case study. *Prod. Plan. Control* 17, 4 (2006), 407–423. DOI:<https://doi.org/10.1080/09537280500483350>
- [2] Saja Ahmed Albliwi, Jiju Antony, and Sarina Abdul Halim Lim. 2015. A systematic review of Lean Six Sigma for the manufacturing industry. *Bus. Process Manag. J.* 21, 3 (2015), 665–691. DOI:<https://doi.org/10.1108/BPMJ-03-2014-0019>
- [3] Majed Alsmadi, Ahmad Almani, and Rula Jerisat. 2012. A comparative analysis of Lean practices and performance in the UK manufacturing and service sector firms. *Total Qual. Manag. Bus. Excell.* 23, 3–4 (2012), 381–396. DOI:<https://doi.org/10.1080/14783363.2012.669993>
- [4] Rodica Pamfilie, Andreea Jenica Petcu (Draghici), and Mihai Draghici. 2012. The Importance of Leadership in Driving a Strategic Lean Six Sigma Management. *Procedia - Soc. Behav. Sci.* 58, (2012), 187–196. DOI:<https://doi.org/10.1016/j.sbspro.2012.09.992>
- [5] Alessandro Laureani and Jiju Antony. 2018. Leadership—a critical success factor for the effective implementation of Lean Six Sigma. *Total Qual. Manag. Bus. Excell.* 29, 5–6 (2018), 502–523. DOI:<https://doi.org/10.1080/14783363.2016.1211480>
- [6] William Hanna Alkunsol, Abdel-Aziz Ahmad Sharabati, Nidal Amin AlSalhi, and Hamza Sultan El-Tamimi. 2019. Lean Six Sigma effect on Jordanian pharmaceutical industry's performance. *Int. J. Lean Six Sigma* 10, 1 (March 2019), 23–43. DOI:<https://doi.org/10.1108/IJLSS-01-2017-0003>
- [7] Frank Gleeson, Paul Coughlan, Lizbeth Goodman, Anthony Newell, and Vincent Hargaden. 2019. Improving manufacturing productivity by combining cognitive engineering and lean-six sigma methods. *Procedia CIRP* 81, (2019), 641–646. DOI:<https://doi.org/10.1016/j.procir.2019.03.169>
- [8] Ekonomski Vjesnik. 2016. Innovations As an Important Factor Influencing Labour Productivity in the Manufacturing Industry. *Rev. Contemp. Entrep. Business, Econ. Issues* 29, 2 (2016), 405–420.
- [9] Ipak Neneng Mardiah Bukit, Yulina Ismida, Rizcy Maulana, and Muhammad Nasir. 2018. The influence of wage, age and experience to labor productivity in construction works in Kota Langsa, Aceh. *MATEC Web Conf.* 147, (January 2018), 06004. DOI:<https://doi.org/10.1051/mateconf/201814706004>
- [10] Dasari Karthik and C. B. Kameswara Rao. 2019. Identifying the significant factors affecting the masonry labour productivity in building construction projects in India. *Int. J. Constr. Manag.* (June 2019), 1–9. DOI:<https://doi.org/10.1080/15623599.2019.1631978>

- [11] Shamil George Naoum. 2016. Factors influencing labor productivity on construction sites. *Int. J. Product. Perform. Manag.* 65, 3 (2016), 401–421. DOI:https://doi.org/10.1108/ijppm-03-2015-0045
- [12] Kit Brooks and Fredrick Muyia Nafukho. 2006. Human resource development, social capital, emotional intelligence. *J. Eur. Ind. Train.* 30, 2 (February 2006), 117–128. DOI:https://doi.org/10.1108/03090590610651258
- [13] M. Sahdat, S.I. Sajjad, M.U. Farooq, and K. Rehman. 2011. Emotional intelligence and organizational productivity: A conceptual study. *World Appl. Sci. J.* 15, 6 (2011), 821–825.
- [14] Abdulaziz M. Jarkas. 2015. Factors influencing labour productivity in Bahrain's construction industry. *Int. J. Constr. Manag.* 15, 1 (2015), 94–108. DOI:https://doi.org/10.1080/15623599.2015.1012143
- [15] W. Timans, J. Antony, K. Ahaus, and R. Van Solingen. 2012. Implementation of Lean Six Sigma in small- and medium-sized manufacturing enterprises in the Netherlands. *J. Oper. Res. Soc.* 63, 3 (2012), 339–353. DOI:https://doi.org/10.1057/jors.2011.47
- [16] Kjeld Harald Aij and Maurits Teunissen. 2017. Lean leadership attributes: a systematic review of the literature. *J. Heal. Organ. Manag.* 31, 7–8 (2017), 713–729. DOI:https://doi.org/10.1108/JHOM-12-2016-0245
- [17] Douglas C. Montgomery. 2016. Why Do Lean Six Sigma Projects Sometimes Fail? *Qual. Reliab. Eng. Int.* 32, 4 (2016), 1279–1279. DOI:https://doi.org/10.1002/qre.2009
- [18] Maneesh Kumar, Jiju Antony, and M. K. Tiwari. 2011. Six Sigma implementation framework for SMEs—a roadmap to manage and sustain the change. *Int. J. Prod. Res.* 49, 18 (2011), 5449–5467. DOI:https://doi.org/10.1080/00207543.2011.563836
- [19] Manisha Lande, R. L. Shrivastava, and Dinesh Seth. 2016. Critical success factors for Lean Six Sigma in SMEs (small and medium enterprises). *TQM J.* 28, 4 (2016), 613–635. DOI:https://doi.org/10.1108/TQM-12-2014-0107
- [20] Alessandro Laureani and Jiju Antony. 2017. Leadership characteristics for Lean Six Sigma. *Total Qual. Manag. Bus. Excell.* 28, 3–4 (2017), 405–426. DOI:https://doi.org/10.1080/14783363.2015.1090291
- [21] Daniela Maria da Costa Nogueira, Paulo S.A. Sousa, and Maria R.A. Moreira. 2018. The relationship between leadership style and the success of Lean management implementation. *Leadersh. Organ. Dev. J.* 39, 6 (2018), 807–824. DOI:https://doi.org/10.1108/LODJ-05-2018-0192
- [22] André Seidel, Tarcísio Abreu Saurin, Giuliano Almeida Marodin, and José Luis Duarte Ribeiro. 2017. Lean leadership competencies: a multi-method study. *Manag. Decis.* 55, 10 (2017), 2163–2180. DOI:https://doi.org/10.1108/MD-01-2017-0045
- [23] Guilherme Tortorella, Desirée H. van Dun, and Amanda Gundes de Almeida. 2019. Leadership behaviors during lean healthcare implementation: a review and longitudinal study. *J. Manuf. Technol. Manag.* (2019). DOI:https://doi.org/10.1108/JMTM-02-2019-0070
- [24] Guilherme Luz Tortorella, Diego de Castro Fettermann, Alejandro Frank, and Giuliano Marodin. 2018. Lean manufacturing implementation: leadership styles and contextual variables. *Int. J. Oper. Prod. Manag.* 38, 5 (2018), 1205–1227. DOI:https://doi.org/10.1108/IJOPM-08-2016-0453
- [25] Peter B. Smith and Mark F. Peterson. 1988. *Leadership, organizations and culture: An event management model.* SAGE Publications Ltd, London.
- [26] Peter G. Northouse. 2016. *Leadership : theory and practice* (Seventh ed ed.). Los Angeles : SAGE, 2016.
- [27] S Robbins and T Judge. 2011. *Organizational Behavior* (fourteenth ed.). Prentice Hall, Upper Saddle River, NJ.
- [28] Everton Drohomieretski, Sergio E. Gouvea Da Costa, Edson Pinheiro De Lima, and Paula Andrea Da Rosa Garbuio. 2014. Lean, six sigma and lean six sigma: An analysis based on operations strategy. *Int. J. Prod. Res.* 52, 3 (2014), 804–824. DOI:https://doi.org/10.1080/00207543.2013.842015
- [29] Kjeld Harald Aij, Merel Visse, and Guy A.M. Widdershoven. 2015. Lean leadership: An ethnographic study. *Leadersh. Heal. Serv.* 28, 2 (2015), 119–134. DOI:https://doi.org/10.1108/LHS-03-2014-0015
- [30] Naga Vamsi Krishna Jastia and Rambabu Kodali. 2015. Lean production: Literature review and trends. *Int. J. Prod. Res.* 53, 3 (2015), 867–885. DOI:https://doi.org/10.1080/00207543.2014.937508
- [31] Roger G. Schroeder, Kevin Linderman, Charles Liedtke, and Adrian S. Choo. 2008. Six Sigma: Definition and underlying theory. *J. Oper. Manag.* 26, 4 (2008), 536–554. DOI:https://doi.org/10.1016/j.jom.2007.06.007
- [32] Rachna Shah and Peter T Ward. 2003. Lean manufacturing: context, practice bundles, and performance. *J. Oper. Manag.* 21, 2 (March 2003), 129–149. DOI:https://doi.org/10.1016/S0272-6963(02)00108-0
- [33] Edward D. Arnheiter and John Maleyeff. 2005. The integration of lean management and Six Sigma. *TQM Mag.* 17, 1 (February 2005), 5–18. DOI:https://doi.org/10.1108/09544780510573020
- [34] Yahia Zare Mehrjerdi. 2011. Six-Sigma: methodology, tools and its future. *Assem. Autom.* 31, 1 (February 2011), 79–88. DOI:https://doi.org/10.1108/01445151111104209
- [35] C SU and C CHOU. 2008. A systematic methodology for the creation of Six Sigma projects: A case study of semiconductor foundry. *Expert Syst. Appl.* 34, 4 (May 2008), 2693–2703. DOI:https://doi.org/10.1016/j.eswa.2007.05.014
- [36] M. P.J. Pepper and T. A. Spedding. 2010. The evolution of lean Six Sigma. *Int. J. Qual. Reliab. Manag.* 27, 2 (2010), 138–155. DOI:https://doi.org/10.1108/02656711011014276
- [37] Roy Andersson, Henrik Eriksson, and Håkan Torstensson. 2006. Similarities and differences between TQM, six sigma and lean. *TQM Mag.* 18, 3 (May 2006), 282–296. DOI:https://doi.org/10.1108/09544780610660004
- [38] Sameer Kumar and Michael Sosnoski. 2009. Using DMAIC Six Sigma to systematically improve shopfloor production quality and costs. *Int. J. Product. Perform. Manag.* 58, 3 (2009), 254–273. DOI:https://doi.org/10.1108/17410400910938850
- [39] Robert House, Mansour Javidan, and Peter Dorfman. 2003. Project GLOBE: An Introduction. *Appl. Psychol.* 50, 4 (2003), 489–505. DOI:https://doi.org/10.1111/1464-0597.00070

- [40] Robin Middlehurst. 1993. *Leading Academics*. Buckingham, UK: SRHE Open University Press.
- [41] Peter Guy Northouse. 2019. *Leadership : theory and practice* (Eighth Edi ed.). Thousand Oaks, California : SAGE.
- [42] Ralph Melvin Stogdill and Alvin E. Coons. 1957. *Leader behavior: its description and measurement*. Ohio State Univer., Bureau of Busin, Oxford, England.
- [43] P Hersey and H Blanchard. 1969. Life cycle theory of leadership. *Train. Dev. J.* 23, 5 (1969), 26–34.
- [44] Francis J. Yammarino and Bernard M. Bass. 1990. Transformational Leadership and Multiple Levels of Analysis. *Hum. Relations* 43, 10 (1990), 975–995. DOI:https://doi.org/10.1177/001872679004301003
- [45] Bernard M Bass. 1996. *A New Paradigm for Leadership: An Inquiry into Transformational Leadership*. Alexandria, VA: U.S Army Research Institute.
- [46] J. M. Burns. 1978. *Leadership*. New York: Harper & Row.
- [47] Robert Greenleaf. 1970. *The servant as leader*. Westfield, IN: Greenleaf Center for servant leadership.
- [48] RK Greenleaf. 2002. *Servant leadership: A journey into the nature of legitimate power and greatness*. New York, NY: Paulist Press.
- [49] L. C. Spears. 2002. *Tracing the past, present, and future of servant-leadership*. In L. C. Spears & M. Lawrence (Eds.), *Focus on leadership: Servant-leadership for 21st century* (pp. 1-16). New York, NY: Wiley.
- [50] Dirk van Dierendonck and Inge Nuijten. 2011. The Servant Leadership Survey: Development and Validation of a Multidimensional Measure. *Journal of Business and Psychology* 26, 249–267. DOI:https://doi.org/10.1007/s10869-010-9194-1
- [51] RC Liden, A Panaccio, J Hu, and JD Meuser. 2014. *Servant leadership: Antecedents, consequences, and contextual moderators*. In D. V. Day (Ed.), *The Oxford handbook of leadership and organizations*. Oxford, UK University Press.
- [52] Robert C. Liden, Sandy J. Wayne, Hao Zhao, and David Henderson. 2008. Servant leadership: Development of a multidimensional measure and multi-level assessment. *Leadersh. Q.* 19, 2 (April 2008), 161–177. DOI:https://doi.org/10.1016/j.leaqua.2008.01.006
- [53] WL Gardner, BJ Avolio, F Luthans, DR May, and Fred Walumbwa. 2005. “Can you see the real me?” A self-based model of authentic leader and follower development. *Leadersh. Q.* 16, (2005), 343–372.
- [54] Bill George and P. Sims. 2007. *True north: discover your authentic leadership*. San Francisco: Jossey-Bass.
- [55] Ajaya K. Swain, Qing Ray Cao, and William L. Gardner. 2018. Six Sigma success: Looking through authentic leadership and behavioral integrity theoretical lenses. *Oper. Res. Perspect.* 5, (2018), 120–132. DOI:https://doi.org/10.1016/j.orp.2018.04.001
- [56] B. George. 2003. *Authentic Leadership: Rediscovering the Secrets to Creating Lasting Value*. San Francisco, CA: Jossey-Bass.
- [57] Gary A Yukl. 2013. *Leadership in organizations* (Eighth edi ed.). Pearson Education Limited.
- [58] Mingze Li, Wenxing Liu, Yi Han, and Pengcheng Zhang. 2016. Linking empowering leadership and change-oriented organizational citizenship behavior: The role of thriving at work and autonomy orientation. *J. Organ. Chang. Manag.* 29, 5 (2016), 732–750. DOI:https://doi.org/10.1108/JOCM-02-2015-0032
- [59] Jay B. Carson, Paul E. Tesluk, and Jennifer A. Marrone. 2007. Shared Leadership in Teams: An Investigation of Antecedent Conditions and Performance. *Acad. Manag. J.* 50, 5 (October 2007), 1217–1234. DOI:https://doi.org/10.5465/amj.2007.20159921
- [60] C.L. Pearce and J. Conger. 2003. *Shared leadership: Reframing the hows and whys of leadership*. Sage, Thousand Oaks, CA.
- [61] Jacky Lumby. 2019. Distributed Leadership and bureaucracy. *Educ. Manag. Adm. Leadersh.* 47, 1 (January 2019), 5–19. DOI:https://doi.org/10.1177/1741143217711190
- [62] Alma Harris and John DeFlaminis. 2016. Distributed leadership in practice. *Manag. Educ.* 30, 4 (October 2016), 141–146. DOI:https://doi.org/10.1177/0892020616656734
- [63] André Seidel, Tarcisio Abreu Saurin, Guilherme Luz Tortorella, and Giuliano Almeida Marodin. 2019. How can general leadership theories help to expand the knowledge of lean leadership? *Prod. Plan. Control* 30, 16 (2019), 1322–1336. DOI:https://doi.org/10.1080/09537287.2019.1612112
- [64] Arnaldo Camuffo and Fabrizio Gerli. 2018. Modeling management behaviors in lean production environments. *Int. J. Oper. Prod. Manag.* 38, 2 (2018), 403–423. DOI:https://doi.org/10.1108/IJOPM-12-2015-0760
- [65] Desirée H. van Dun, Jeff N. Hicks, and Celeste P.M. Wilderom. 2017. Values and behaviors of effective lean managers: Mixed-methods exploratory research. *Eur. Manag. J.* 35, 2 (2017), 174–186. DOI:https://doi.org/10.1016/j.emj.2016.05.001
- [66] Guilherme Tortorella, Diego Fettermann, Michel Anzanello, and Rapinder Sawhney. 2017. Lean manufacturing implementation, context and behaviors of multi-level leadership A mixed-methods exploratory research. *J. Manuf. Technol. Manag.* 28, 7 (2017), 867–891. DOI:https://doi.org/10.1108/JMTM-06-2017-0128
- [67] Guilherme Tortorella and Flávio Fogliatto. 2017. Implementation of lean manufacturing and situational leadership styles: An empirical study. *Leadersh. Organ. Dev. J.* 38, 7 (2017), 946–968. DOI:https://doi.org/10.1108/LODJ-07-2016-0165
- [68] Marcel F. van Assen. 2018. Exploring the impact of higher management’s leadership styles on Lean management. *Total Qual. Manag. Bus. Excell.* 29, 11–12 (2018), 1312–1341. DOI:https://doi.org/10.1080/14783363.2016.1254543
- [69] Bozena Poksinska, Dag Swartling, and Erik Drotz. 2013. The daily work of Lean leaders - lessons from manufacturing and healthcare. *Total Qual. Manag. Bus. Excell.* 24, 7–8 (2013), 886–898. DOI:https://doi.org/10.1080/14783363.2013.791098
- [70] Lisa van Rossum, Kjeld Harald Aij, Frederique Elisabeth Simons, Niels van der Eng, and Wouter Dirk ten Have. 2016. Lean healthcare from a change management perspective: The role of leadership and workforce flexibility in an operating

- theatre. *J. Heal. Organ. Manag.* 30, 3 (2016), 475–493.
DOI:<https://doi.org/10.1108/JHOM-06-2014-0090>
- [71] Benbo Li, Abraham Y. Nahm, Rebecca Wyland, Jian Yu Ke, and Wei Yan. 2015. Reassessing the role of Chinese workers in problem solving: a study of transformational leadership, trust and security in ‘lean’ manufacturing. *Asia Pacific Bus. Rev.* 21, 4 (2015), 464–481.
DOI:<https://doi.org/10.1080/13602381.2014.950056>
- [72] Kjeld Harald Aij and Sofia Rapsaniotis. 2017. Leadership requirements for Lean versus servant leadership in health care: A systematic review of the literature. *J. Healthc. Leadersh.* 9, (2017), 1–14.
DOI:<https://doi.org/10.2147/JHL.S120166>
- [73] Bozena Poksinska, Dag Swartling, and Erik Drotz. 2013. The daily work of Lean leaders - lessons from manufacturing and healthcare. *Total Qual. Manag. Bus. Excell.* 24, 7–8 (August 2013), 886–898.
DOI:<https://doi.org/10.1080/14783363.2013.791098>
- [74] Robert Jones, James Latham, and Michela Betta. 2013. Creating the illusion of employee empowerment: Lean production in the international automobile industry. *Int. J. Hum. Resour. Manag.* 24, 8 (2013), 1629–1645.
DOI:<https://doi.org/10.1080/09585192.2012.725081>
- [75] Sandra Jönsson and Tobias Schölin. 2014. Potentials facilitators of workplace learning in a TPS based company. *J. Manag. Dev.* 33, 10 (2014), 1004–1018.
DOI:<https://doi.org/10.1108/JMD-10-2012-0130>
- [76] Desirée H. van Dun and Celeste P.M. Wilderom. 2016. Lean-team effectiveness through leader values and members’ informing. *Int. J. Oper. Prod. Manag.* 36, 11 (2016), 1530–1550. DOI:<https://doi.org/10.1108/IJOPM-06-2015-0338>
- [77] J. Liker and G. Convis. 2011. *The Toyota Way to Lean Leadership: Achieving and Sustaining Excellence Through Leadership Development*. McGraw Hill, New York, NY.
- [78] Thomas Bortolotti, Stefania Boscari, and Pamela Danese. 2015. Successful lean implementation: Organizational culture and soft lean practices. *Int. J. Prod. Econ.* 160, (February 2015), 182–201.
DOI:<https://doi.org/10.1016/j.ijpe.2014.10.013>
- [79] JP Womack and DT Jones. 2003. *Lean thinking : banish waste and create wealth in your corporation*. New York: Simon and Shuster.
- [80] KJ Duggan. 2012. *Creating mixed model value streams: practical lean techniques for building to demand*. CRC Press, London.
- [81] M Rother and R Harris. 2001. *Creating continuous flow: an action guide for managers, engineers & production associates*. Lean Enterprise Institute, London. Retrieved from [https://books.google.com/books?hl=en&lr=&id=tHMNeTWQT7gC&oi=fnd&pg=PP3&dq=Rother,+M.+and+Harris,+R.+\(2001\),+Creating+Continuous+Flow:+An+Action+Guide+for+Managers,+Engineers+%26+Production+Associates,+Lean+Enterprise+Institute,+London&ots=K73qeENWik&sig=O](https://books.google.com/books?hl=en&lr=&id=tHMNeTWQT7gC&oi=fnd&pg=PP3&dq=Rother,+M.+and+Harris,+R.+(2001),+Creating+Continuous+Flow:+An+Action+Guide+for+Managers,+Engineers+%26+Production+Associates,+Lean+Enterprise+Institute,+London&ots=K73qeENWik&sig=O)
- [82] Steven J Spear. 2004. Learning to Lead at Toyota. *Harv. Bus. Rev.* 28, 5 (2004), 78–91.
- [83] Martens Reiner. 2018. Leadership to lean. *IEEE Technol. Eng. Manag. Conf. TEMSCON 2018* (2018).
DOI:<https://doi.org/10.1109/TEMSCON.2018.8488413>
- [84] A. Gregory Stone, Robert F. Russell, and Kathleen Patterson. 2004. Transformational versus servant leadership: A difference in leader focus. *Leadersh. Organ. Dev. J.* 25, 4 (June 2004), 349–361.
DOI:<https://doi.org/10.1108/01437730410538671>
- [85] Robert C. Ford and Myron D. Fottler. 1995. Empowerment: A matter of degree. *Acad. Manag. Perspect.* 9, 3 (August 1995), 21–29.
DOI:<https://doi.org/10.5465/ame.1995.9509210269>
- [86] Christopher S. Kim, David A. Spahlinger, Jeanne M. Kin, and John E. Billi. 2006. Lean health care: What can hospitals learn from a world-class automaker? *J. Hosp. Med.* 1, 3 (May 2006), 191–199. DOI:<https://doi.org/10.1002/jhm.68>
- [87] A.L. Grove, J.O. Meredith, M. MacIntyre, J. Angelis, and K. Neailey. 2010. UK health visiting: challenges faced during lean implementation. *Leadersh. Heal. Serv.* 23, 3 (July 2010), 204–218.
DOI:<https://doi.org/10.1108/17511871011061037>
- [88] Cindy Jimmerson, Dorothy Weber, and Durward K. Sobek. 2005. Reducing Waste and Errors: Piloting Lean Principles at Intermountain Healthcare. *Jt. Comm. J. Qual. Patient Saf.* 31, 5 (May 2005), 249–257. DOI:[https://doi.org/10.1016/S1553-7250\(05\)31032-4](https://doi.org/10.1016/S1553-7250(05)31032-4)
- [89] Alannah E. Rafferty and Mark A. Griffin. 2004. Dimensions of transformational leadership: Conceptual and empirical extensions. *Leadersh. Q.* 15, 3 (2004), 329–354.
DOI:<https://doi.org/10.1016/j.leaqua.2004.02.009>
- [90] Dong I. Jung, Chee Chow, and Anne Wu. 2003. The role of transformational leadership in enhancing organizational innovation: Hypotheses and some preliminary findings. *Leadersh. Q.* 14, 4–5 (2003), 525–544.
DOI:[https://doi.org/10.1016/S1048-9843\(03\)00050-X](https://doi.org/10.1016/S1048-9843(03)00050-X)
- [91] Purit Pongpeachan. 2016. Effect of transformational leadership on strategic human resource management and firm success of Toyota’s dealer in Thailand. *J. Bus. Retail Manag. Res.* 10, 2 (2016), 53–63. Retrieved October 21, 2019 from <http://search.proquest.com/openview/af770bc8033af3bbbe0a5440b8e7b53b/1?pq-origsite=gscholar&cbl=2035949>
- [92] René van Eeden, Frans Cilliers, and Vasi van Deventer. 2008. Leadership Styles and Associated Personality Traits: Support for the Conceptualisation of Transactional and Transformational Leadership. *South African J. Psychol.* 38, 2 (June 2008), 253–267.
DOI:<https://doi.org/10.1177/008124630803800201>



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Leadership that facilitates the successful implementation of Lean Six Sigma

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