How to Run a Project more effectively using Lean Management

Essa Hamed Alluhaybi [a] – Abdulmoniem Yassin Alshahri [b]

[a,b] Department of Information Science - College of Arts and Humanities

King Abdul-Aziz University - Jeddah - KSA

Abstract: Lean management has been commented as being one of the most effective and efficient forms of management through waste minimisation and maximising resource utilisation. Organisations have two types of lean management concerns, social and technical. Social lean management involves managing the human-centric aspects of the organisation, and technical lean management involves the use of training, tools, operations management and organisational culture. SWOT analysis of both social and technical factors are conducted. Social factors include human resource management, leadership management, and employee management. Technical factors include operations management, and organisational culture. The SWOT analysis reveals that the strength of lean management is in its ability to holistically improve the knowledge, skills, communication, collaborative efforts, motivation to work, health and safety protocols, transparency, trust, effectiveness and efficiency of the organisation. Weaknesses of lean management lies in its high requirements of investment, in terms of money, time, and effort, with a lot of resources needing to be dedicated to training and management, in buying operations management tools and in hiring coaches for leadership roles, with success being the only option due to low tolerance of error. In terms of opportunity, it allows an organisation to become more noticeable in the market, innovate more, collaborate more, create stronger relationships, ore out of workers by encouraging them to go above and beyond the minimum requirements of their jobs, and create leaders from within the organisation. Finally, lean management can be a threat for those organisations that falter, or cannot dedicate fully to lean implementation stages, incurring huge losses for the organisation, and causing them to fall behind in the competition, as well as pose a risk of low job satisfaction due to large levels of stress from high expectations of needing to adapt quickly. Based on the SWOT analysis, future recommendations are made for organisation to adopt lean management.

Keywords: Lean management, SWOT, effectiveness, efficiency, social factors, technical factors

1 Introduction

1.1 Lean Management

Lean management has been defined as a process that maximise resource utilisation and provides the highest value to customers while using the least number of resources possible (Womack & Jones, 2003). Lean management has also been described as a set of management practices that provide the best possible service to customers while eliminating all sources of waste and inefficiency through tools assistance that improves on the process of production and manufacturing (Allway & Corbett, 2002). Fundamentally, an organisation managed by lean

practices aims to decrease the number of defects in the number of units of production, increase production efficiency, and diversify product variety (Shah & Ward, 2003).

While the definitions indicate that lean management is a technical process, involving tools and machineries, there are also important social aspects of lean management. However, explicitly focusing on one would not ensure improvement in the effectiveness and efficiency of operational performance. Social lean management practices are concerned with the involvement of achieving leanness in an organisation by encouraging lean behaviour among people in the organisation, for example, in positions of management, partnerships, services, trainings, and focus groups (Abdallah et al., 2021). Technical lean management practices are seen in the tools and techniques used in production, in the methodology of operations, the protocols, knowledge implementation, and production line (Abdallah & Alkhaldi, 2019). For the most effective and efficient lean management a combinatory approach is desired (Abdallah & Alkhaldi, 2019).

1.2 Indicators of Lean Management

An organisation can analyse the effectiveness and efficiency of lean management using several indicators. Common indicators are the reduction in the number of items that stays stored in inventory over a certain period (Schonberger, 2019), a reduction in the length of time needed to detect the root cause of problems and inefficiencies in the production line, a reduction in the number of rejected produced units, an increase in the reliability in the production line, and an increase in the number of on-time deliveries in the supply chain (Mishra & Rane, 2019). These indicators are also known as operational performance and can include additional indicators such as the cost of production, quality of finished products, a target time set for on-time delivery, levels of adaptability, flexibility, and time to market (Abdallah & Al-Ghwayeen, 2019; Cadden et al., 2020).

2 Methodology

This study uses a theoretical research approach and explores the effectiveness of using lean management. The effectiveness of lean management is determined using a SWOT analysis. SWOT stands for Strengths, Weaknesses, Opportunities, and Threats, and is used to explore both the internal and external factors impacting the performance of an artefact. The artefact explored in this study is lean management, with particular focus on the SWOT of social and technical factors.

This study is secondary in nature and presents the theoretical SWOT of 3 social factor dimensions and 2 technical factor dimensions. Social factors that have been identified in this research are human resource management, leadership management, and employee management. The technical factors identified are operations management and organisational culture. The SWOT analysis of the factors are provided in the next chapter.

3 Discussion

3.1 SWOT Analysis of Lean Management of Social Factors

The effectiveness and efficiency of lean management is correlated to a multitude of factors, both social and technical. Organisations aiming to implement lean management into their operations have a substantial task of dedication, commitment, flexibility, and adaptability. The intention or act alone of implementing lean management does not guarantee a high level of effectiveness or efficiency of lean practices. Each aspect of lean

management has implications of strength, weaknesses, opportunities, and threats to the organisation (SWOT). This section overviews the SWOT implications of each element of lean management.

3.1.1 Human Resource Management

Regarding all things human-centric in lean management, the human resource department plays the most crucial role. From the very early stages, human resource departments should work in tandem with performance managers so that targeted practices, such as Just-in-time and Total Quality Management are achieved concretely (van Assen & de Mast, 2019). The hard and soft practices of lean management are directly related to the work practices in the physical environment, all of which revolve around human factors (Gaiardelli et al., 2019). When the Human Resources department can bring into action the best practices, only then can these human factors come into functionalising lean operations (Gonzalez et al., 2019). The Human Resources department must assume new responsibilities for lean management implementation and for lean management to be effective and efficient. One of the new roles that Human Resource departments have to bear is the identification of the various points in organisational operations where lean practices have to be implemented, as well as communicate the expectations of lean production to the rest of the organisation, particularly for manufacturing organisations (Jasti & Kodali, 2019).

The hiring process also evolves when an organisation practices lean management. The Human Resources department is expected to realise and understand what competencies consistent with lean philosophies are required at a corporate level during candidate selection processes (Kregel et al., 2019). Effective lean management, particularly in lean production, is highly dependent on human resource management practices, and the designing, deployment and implementation of the practices. These practices have to be individually attended to by the Human Resource departments because the impact of each practice, and the interaction between the factors of lean production have to be analysed and compared constantly to achieve organisational excellence (Wickramasinghe & Wickramasinghe, 2020). The decisions of the Human Resources department regarding investment in intellectual and human capital dedicated to lean implementation directly impacts the efficacy of lean management (Onofrei et al., 2019).

To get the best out of its employees, the human resources department has to encourage commitment from top managers and those in leadership roles in the organisation. The effectiveness and efficiency of lean management would depend on the effectiveness and efficiency of the human resource departments in training the employees, following schedule, taking active steps to increase high attendance during meetings, track learning outcomes from the training, and promote continuous learning even after training. Initial success can drive employee motivation and increases the involvement of the workforce in adopting lean methodologies.

The effectiveness and efficiency of lean management would suffer if commitment from the Human Resources department is lacklustre. If Human Resources personnel fail to adhere to lean practices, lean ideologies would not be transferred successfully to employees, and lean methods would not be fully respected. The organisation would not see unanimous adoption of lean management practices as the employees would not be led by example and increase chances of employees' resistance to change. Thus, if an organisation does not have adamant lean objectives coming straight from the Human Resources department, it is highly likely that there would be poor

communication, cooperation and coordination and lean management implementation efforts would be a barrier to organisation effectiveness and efficiency.

Based on the findings, the following SWOT analysis of lean human resource management is presented in Table1.

Table 1 SWOT implications of lean Human Resource Management

Human Resource Management			
Strength	**Weaknesses**	**Opportunities**	**Threats**
Robust personnel hiring protocol Streamlined communication between all levels of production Directly improves work practices in the physical environment	Skill requirement too high High expectation and low tolerance of error increases expenses Highly dependent on high success rate of lean management implementation at each level of production	Better identify competency requirement for the organisation Create highly competent top management and leadership roles	Threat to effectiveness and efficiency of entire organisation if commitment is lacklustre Very high chance of failure unless virtually every single employee is not adamant on following lean objectives

3.1.2 Leadership Management

Leaders play the crucial role of guiding employees towards lean philosophies. The effectiveness and efficiency of lean management is dependent on the openness of two-way communications, both top-down from the chain of command, and bottom-up from the labour force to upper-management (Burawat, 2019). Ineffective leadership qualities can result in lean management strategies failing (Dave & Sohani, 2019). Therefore, the willingness of leaders to guide, as well as to listen is imperative to the success of lean management. An organisation has multiple leaders in each in each process of production who bear the responsibility of managing lean practices in the technology and tools involved, production technique and production process (Grigg et al., 2020). It is imperative for all the leaders to have lean ideologies and to communicate them clearly to encourage employees to follow their lead. An effective leader would also encourage their employees to want to take leadership roles for themselves by being knowledgeable about lean philosophies (Knol et al., 2019).

Lean coaches who guide organisations towards lean management play the first leadership roles. They lead during the training programs, and should encourage employees to engage in knowledge accumulation, dissemination, and application. Lean coaches should not assume an authority figure but rather encourage employees to arrive to conclusions consistent with lean philosophies by their own efforts (Mansoori et al., 2019). This can effectively ensure all employees have the same goal-oriented approach to understanding lean management. Furthermore, this would allow employees to ask their own questions regarding lean philosophy. A supportive leader should respect employees' queries, which, when clarified can facilitate both front-end and back-end lean processes (Solaimani et al., 2019). The SWOT analysis of lean leadership management is presented in Table 2.

Table 2 SWOT analysis of lean leadership management

Leadership Management			
Strength	**Weaknesses**	**Opportunities**	**Threats**
Improves two-way communication up and down the chain of command throughout the organisation Highly motivates employees Promotes accumulation, dissemination, and application of knowledge throughout the organisation	Large expense of recruiting lean trainers and coaches in top management positions Employees are heavily reliant on top management and leaders Requires leaders to always stay motivated with low tolerance of error	Strong leadership can drastically encourage lean adoption throughout the organisation Potential to create leaders from within the organisation from any rank	Ineffective leadership qualities can result in lean management strategies failing

3.1.3 Employee Management

At the heart of the organization are its employees, without whom, managers would not be able to execute lean operations. Therefore, when analysing social lean practices, employees should be given extremely high priority. Managers should constantly seek feedback from employees regarding their level of satisfaction from the training sessions, and the expectations from the organisation about their knowledge dissemination strategies on lean management (Beraldin et al., 2019). It is often seen that employees report lower job satisfaction during lean management implementation stages (Minh et al., 2019), but in maturity phases of lean management, employees have higher efficacies of meeting organisational goals following lean practices (Beraldin et al., 2019). The effectiveness and efficiency of lean management is also observed to have a higher positive correlation with health and safety practices implemented earlier on in lean implementation strategies (Stimec & Grima, 2019). Since lean practices often demand top-to-bottom overhaul of organisational practices, and requires higher skill levels from employees, there lies the risk of emotional and mental stress, alongside the physical exhaustion of needing to exert extra effort during lean implementation phases. Organisations whose Human Resource departments employ health and safety professionals it instils stronger trust and faith among employees in the ability of the organisation to execute the lean management implementation strategies effectively (Thornton et al., 2019). As a result, there is an overall higher level of compliance, participation, effort, and caution exercised by employees, which leads to higher effectiveness and efficiency of lean management.

Lean management processes are taxing and demanding on employees who do not have the willingness to commit to fully understanding the motivations behind lean implementation. Employee participation is a non-negotiable requirement when an organisation is in lean implementation stages. The effectiveness of lean management has

been observed to be significantly higher when organisations monitoring participation. It is highly important to keep track of employees' records of attending meetings, number of PDCAs (Plan, Do, Check, Act) opened and closed over a certain period of time, and to take qualitative notes of employee attitude towards participation requirements (Beraldin et al., 2019). Negative attitudes, or having a lack of enthusiasm for participation are cause inefficiencies of implementing lean management. Particularly, the return on investment is significantly affected if employee participation is not meeting expectations of lean practices (Galeazzo, 2021). Employees' participations go beyond fulfilling their bare minimum job requirements, and well-trained employees, who are well-versed on lean philosophies, would be willing to participate in leadership roles, and make decisions congruent to lean management expectations (Hernandez-Matias et al., 2019).

The SWOT analysis of lean employee management is presented in Table 3.

Table 3 SWOT analysis of lean employee management

Employee Management			
Strength	**Weaknesses**	**Opportunities**	**Threats**
Promotes transparency of communication between employees and leaders Higher efficacies of meeting organisational goals in mature stages of lean implementation Successful lean management implementation can improve employee trust in organisation	Expects all workers to be on board with the high level of effort required to implement lean management Non-negotiable levels of commitment required of employees Managerial difficulties arising from requirement to meticulously keep records of employee participation	Provides opportunities of continuous improvement from employer feedback Better health and safety standardisations for employees Can motivate employees to go above and beyond the required job description to get ahead in the organisation	Lower job satisfaction during initial stages of lean implementation High emotional and mental stress during lean implementation stages Threat to those employees unable to adapt to lean philosophies in short duration

3.2 SWOT Analysis of Lean Management of Technical Factors

3.2.1 Operations Management

Lean methodology is a reliable process but requires sincere commitment in all levels of operations. Organisations are required to have specific performance measurement systems according that allow them to monitor their operations and analyse whether they are consistent to lean methodology. If an organisation is adamant about becoming lean, these measurement systems can be highly effective. The measurements can be monitored using technology management systems for operations, and information management systems for database handling. However, these management tools are highly expensive and is a commitment to an investment with no promise of returns. In order to get the returns of these investments, lean practices have to be seen through all the way. This means, organisations with resource constraints will see lean management practices as a barrier. Compromising on operations management tools, or partially fulfilling lean management strategies would result in inaccurate

representations of organisation leanness, resulting in long-term ineffective of outcomes. Organisations compromising on operations management risk falling behind the competition.

The efficiency and effectiveness of lean management involves a holistic approach to implementing lean strategies. One of the first steps in ensuring smooth operations is in training the organisation as a whole in the practices of lean management. This training is paramount, and serves as the stepping stone for lean management. It is required that top managers fully understand lean concepts, terminologies and their implementation procedures before expecting employees to commit and cooperate with the organisation (Burawat, 2019). Therefore, top-managers must also undergo extensive training in lean management. A crucial part of the training is to constantly reiterate to employees and managers what the long-term and medium-term goals of the organisation are, and how lean management presents the opportunity to fulfil them (Chiarini & Brunetti, 2019). Successful training sessions should inspire willingness and motivation among employees to learn more about lean management which can directly impact its long-term effectiveness and efficiency (Valente et al., 2019). Additionally, organisations should invest in in-house training. Training done in-house by lean practitioners have resulted in higher effectiveness of lean management adoption strategies (Grigg et al., 2020; Thornton et al., 2019).

Smooth, lean operations, also depend on high levels of collaboration, communication, and connectedness. Therefore, teamwork is a highly crucial success factor for lean management strategies to be effective (Mathew & Taylor, 2019) and should be evident in both soft and hard lean practices (Sakthi Nagaraj et al., 2019). Lean management implementation process should encourage lean teamwork practices during training where employees develop a habit of learning from each other through collaboration, while balancing the various characteristics of members in the team (Tortorella et al., 2019). While it is expected that all employees should be individually capable of adhering to lean principles, it is a significant effort to effectively work as a hive-mind where all members in a team's individual goals are identically aligned. Therefore, practicing teamwork for employees to align all organisational goals is essential to the effectiveness and efficiency of lean management.

The SWOT analysis of lean operations management is provided in Table 4.

Table 4 SWOT Analysis of lean operations management

Operations Management			
Strength	**Weaknesses**	**Opportunities**	**Threats**
High-precision operations management monitoring Organisations see very high returns on investment upon successful lean implementation Highly integrated collaborative efforts drastically improve efficiency	Difficult performance measurement metrics Requires operations management tools Requires heavy investment in management tools with no guarantee of return on investment Not available to organisations with resource constraints	High efficiency of operations in all levels of organisation Highly trained workforce Create stronger relationships through collaborative work	Even lower levels of mismanagement can result in long-term ineffective outcomes Risk of falling behind the competition if not all lean objectives can be achieved One failure in the chain of collaboration can cause lean operations to halt

3.2.2 Organisational Culture

An organisation culture that respects flexibility, adaptability, and openness to new ideas is crucial for lean management to be effective (Abdallah et al., 2019). Effectiveness of lean practices in manufacturing technologies are seen to be noticeable only when the organisational culture fosters a supportive environment, promotes awareness of lean implementation strategies, and reinforces organisational pride in attempting to adopt a lean-based culture (Dave & Sohani, 2019). Holistic cultural change makes lean management strategies effective. Human-centric approaches that are complementary to technical aspects of lean management can promote the adoption of an organisational culture that thrives for more knowledge, learning opportunities, appreciating employees, collaborative efforts, and coaching (Solaimani et al., 2019). Leaders who fail to realise and prioritise adapting organisational culture to be in line with lean philosophies either find failures or poor effectiveness of lean management strategies (Valente et al., 2019).

Commitment is required from the entire organisation. Lean management is effective when the organisation commits time, money, and energy entirely to achieving their goals explicitly using lean principles (Abu et al., 2019). The commitment has to come first and foremost from top management, and the commitment has to be directed towards identifying the crucial elements of operations that require lean implementation, and a thorough understanding of how the lean implementation project has to be conducted (Jasti & Kodali, 2019). A common mistake made by those in managerial positions that impacts the effectiveness of lean management implementation is to hesitate in lean implementation strategies when employees show initial decline in performance matrices (Salhieh & Abdallah, 2019). This is simply because employee skills have not yet matured to be consistent with lean philosophy, as the process requires iterative improvements. Managers not being able to commit through perceived aberrations fail to successfully implement lean management in their organisations. As a result, lack of commitment can significantly impact the effectiveness and efficiency of lean management. The SWOT analysis of lean organisational culture is presented in Table 5.

Table 5 SWOT analysis of lean organisational culture

Organisational culture			
Strength	**Weaknesses**	**Opportunities**	**Threats**
Makes organisation more flexible, adaptable, and open to the changing demands of the market Promotes an environment of support and increased awareness for continuous improvement Makes organisation more effective Makes organisation more efficient	Requires time for organisation to adapt to the new culture Requires high levels of commitment of time, money, and energy Inevitable initial aberrations are the most common cause of failure from leaders' part due to lack of faith in lean philosophy	Organization can become more innovative as a whole Organisation can become more collaborative Organisation can make a stronger presence in the market	Potential points of failures of lean management could incur large financial cost to organisation

3.3 Current and Future Direction of Lean Management

Organisations are adopting lean management provided they have the resources and dedication to commit to holistically implement lean practices. Current practices involve positive feedback of learning and incremental improvements which gradually achieves leanness in an organisation. Organisations aim to direct their efforts parallelly in all lean objectives, mainly eliminating waste (Bicheno & Holweg, 2016), achieving just-in-time delivery, continuous improvement (Costa et al., 2019), improve quality, visual communication, and human resource management (Bacoup et al., 2018; Mascarenhas et al., 2019). While these efforts are extremely challenging, lean management can become a lot more achievable in the future due to the advent of industry 4.0.

The term industry 4.0 encompasses the use of smart and intelligent technology to massively transform industrial operations (Müller et al., 2018). Lean management has started involving smart products capable of communicating with each other, and self-optimising the manufacturing processes. Large volumes of real-time, fast-flowing, Big Data are being utilised for optimisation to a high precision level (Oztemel & Gursev, 2020). The revolution of industry 4.0 is an ongoing process, and therefore lean management methodologies are highly significant in this ongoing revolution (Závadská & Závadský, 2020).

4 Conclusion & Recommendations

The effectiveness and efficiency of lean management is dependent on the extent to which an organisation is able to overcome the barriers of strategic approach. This involves adamant commitment to training, a culture of learning, and clear organisational goals entirely oriented with lean philosophies. Organisation cannot become lean overnight. It happens in phases, but parallelly across all stages of production. Organisations have to have the capability to absorb the blunt of the dynamic nature of environmental complexities that inevitably arise whenever organisation attempt to become lean.

It can be recommended that organisations should focus on the strength of industry 4.0 to start adopting smart lean management strategies. Better vertical integration of supply-chain management can be autonomously achievable, which can increase value to customers. With Big Data collection, gathering, processing, and analysis lean management can become even more effective and efficient if executed correctly.

References

Abdallah, A. B., & Al-Ghwayeen, W. S. (2019). Green supply chain management and business performance. *Business Process Management Journal*, *26*(2), 489–512. https://doi.org/10.1108/BPMJ-03-2018-0091

Abdallah, A. B., & Alkhaldi, R. Z. (2019). Lean bundles in health care: a scoping review. *Journal of Health Organization and Management*, *33*(4), 488–510. https://doi.org/10.1108/JHOM-09-2018-0263

Abdallah, A. B., Alkhaldi, R. Z., & Aljuaid, M. M. (2021). Impact of social and technical lean management on operational performance in manufacturing SMEs: the roles of process and management innovations. *Business Process Management Journal*, *27*(5), 1418–1444. https://doi.org/10.1108/BPMJ-06-2020-0252

Abdallah, A. B., Dahiyat, S. E., & Matsui, Y. (2019). Lean management and innovation performance. *Management Research Review*, *42*(2), 239–262. https://doi.org/10.1108/MRR-10-2017-0363

Abu, F., Gholami, H., Mat Saman, M. Z., Zakuan, N., & Streimikiene, D. (2019). The implementation of lean manufacturing in the furniture industry: A review and analysis on the motives, barriers, challenges, and the applications. *Journal of Cleaner Production*, *234*, 660–680. https://doi.org/10.1016/j.jclepro.2019.06.279

Allway, M., & Corbett, S. (2002). Shifting to lean service: Stealing a page from manufacturers' playbooks. *Journal of Organizational Excellence*, *21*(2), 45–54. https://doi.org/10.1002/npr.10019

Bacoup, P., Michel, C., Habchi, G., & Pralus, M. (2018). From a quality management system (QMS) to a lean quality management system (LQMS). *TQM Journal*, *30*(1), 20–42. https://doi.org/10.1108/TQM-06-2016-0053

Beraldin, A. R., Danese, P., & Romano, P. (2019). An investigation of the relationship between lean and well-being based on the job demands-resources model. *International Journal of Operations & Production Management*, *39*(12), 1295–1322. https://doi.org/10.1108/IJOPM-05-2019-0377

Bicheno, J., & Holweg, M. (2016). *The Lean Toolbox*. Picsie Books.

Burawat, P. (2019). The relationships among transformational leadership, sustainable leadership, lean manufacturing and sustainability performance in Thai SMEs manufacturing industry. *International Journal of Quality & Reliability Management*, *36*(6), 1014–1036. https://doi.org/10.1108/IJQRM-09-2017-0178

Cadden, T., Millar, K., Treacy, R., & Humphreys, P. (2020). The mediating influence of organisational cultural practices in successful lean management implementation. *International Journal of Production Economics*, *229*, 107744. https://doi.org/10.1016/j.ijpe.2020.107744

Chiarini, A., & Brunetti, F. (2019). What really matters for a successful implementation of Lean production? A multiple linear regression model based on European manufacturing companies. *Production Planning & Control*, *30*(13), 1091–1101. https://doi.org/10.1080/09537287.2019.1589010

Costa, F., Lispi, L., Staudacher, A. P., Rossini, M., Kundu, K., & Cifone, F. D. (2019). How to foster Sustainable Continuous Improvement: A cause-effect relations map of Lean soft practices. *Operations Research Perspectives*, *6*, 100091. https://doi.org/10.1016/j.orp.2018.100091

Dave, Y., & Sohani, N. (2019). Improving productivity through Lean practices in central India-based manufacturing industries. *International Journal of Lean Six Sigma*, *10*(2), 601–621. https://doi.org/10.1108/IJLSS-10-2017-0115

Gaiardelli, P., Resta, B., & Dotti, S. (2019). Exploring the role of human factors in lean management. *International Journal of Lean Six Sigma*, *10*(1), 339–366. https://doi.org/10.1108/IJLSS-08-2017-0094

Galeazzo, A. (2021). Degree of leanness and lean maturity: exploring the effects on financial performance. *Total Quality Management & Business Excellence*, *32*(7–8), 758–776. https://doi.org/10.1080/14783363.2019.1634469

Gonzalez, M. E., Quesada, G., Mora-Monge, C. A., & Barton, M. E. (2019). An Empirical Study of the Application of Lean Tools in U.S. Industry. *Quality Management Journal*, *26*(4), 174–190.

https://doi.org/10.1080/10686967.2019.1647769

Grigg, N. P., Goodyer, J. E., & Frater, T. G. (2020). Sustaining lean in SMEs: key findings from a 10-year study involving New Zealand manufacturers. *Total Quality Management & Business Excellence*, *31*(5–6), 609–622. https://doi.org/10.1080/14783363.2018.1436964

Hernandez-Matias, J. C., Ocampo, J. R., Hidalgo, A., & Vizan, A. (2019). Lean manufacturing and operational performance. *Journal of Manufacturing Technology Management*, *31*(2), 217–235. https://doi.org/10.1108/JMTM-04-2019-0140

Jasti, N. V. K., & Kodali, R. (2019). An empirical investigation on lean production system framework in the Indian manufacturing industry. *Benchmarking: An International Journal*, *26*(1), 296–316. https://doi.org/10.1108/BIJ-10-2017-0284

Knol, W. H., Slomp, J., Schouteten, R. L. J., & Lauche, K. (2019). The relative importance of improvement routines for implementing lean practices. *International Journal of Operations & Production Management*, *39*(2), 214–237. https://doi.org/10.1108/IJOPM-01-2018-0010

Kregel, I., Ogonek, N., & Matthies, B. (2019). Competency profiles for lean professionals – an international perspective. *International Journal of Productivity and Performance Management*, *68*(2), 423–446. https://doi.org/10.1108/IJPPM-09-2017-0237

Mansoori, Y., Karlsson, T., & Lundqvist, M. (2019). The influence of the lean startup methodology on entrepreneur-coach relationships in the context of a startup accelerator. *Technovation*, *84–85*, 37–47. https://doi.org/10.1016/j.technovation.2019.03.001

Mascarenhas, R., Pimentel, C., & Rosa, M. (2019). The way lean starts – a different approach to introduce lean culture and changing process with people's involvement. *Procedia Manufacturing*, *38*, 948–956. https://doi.org/10.1016/j.promfg.2020.01.178

Mathew, S., & Taylor, G. (2019). Power distance in India. *Cross Cultural & Strategic Management*, *26*(1), 2–23. https://doi.org/10.1108/CCSM-02-2018-0035

Minh, K. S., Zailani, S., Iranmanesh, M., & Heidari, S. (2019). Do lean manufacturing practices have negative impact on job satisfaction? *International Journal of Lean Six Sigma*, *10*(1), 257–274. https://doi.org/10.1108/IJLSS-11-2016-0072

Mishra, N., & Rane, S. B. (2019). Prediction and improvement of iron casting quality through analytics and Six Sigma approach. *International Journal of Lean Six Sigma*, *10*(1), 189–210. https://doi.org/10.1108/IJLSS-11-2017-0122

Müller, J. M., Buliga, O., & Voigt, K.-I. (2018). Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0. *Technological Forecasting and Social Change*, *132*, 2–17. https://doi.org/10.1016/j.techfore.2017.12.019

Onofrei, G., Prester, J., Fynes, B., Humphreys, P., & Wiengarten, F. (2019). The relationship between investments

in lean practices and operational performance. *International Journal of Operations & Production Management*, *39*(3), 406–428. https://doi.org/10.1108/IJOPM-04-2018-0201

Oztemel, E., & Gursev, S. (2020). Literature review of Industry 4.0 and related technologies. *Journal of Intelligent Manufacturing*, *31*(1), 127–182. https://doi.org/10.1007/s10845-018-1433-8

Sakthi Nagaraj, T., Jeyapaul, R., Vimal, K. E. ., & Mathiyazhagan, K. (2019). Integration of human factors and ergonomics into lean implementation: ergonomic-value stream map approach in the textile industry. *Production Planning & Control*, *30*(15), 1265–1282. https://doi.org/10.1080/09537287.2019.1612109

Salhieh, L., & Abdallah, A. A. (2019). A two-way causal chain between lean management practices and lean values. *International Journal of Productivity and Performance Management*, *68*(5), 997–1016. https://doi.org/10.1108/IJPPM-08-2018-0289

Schonberger, R. J. (2019). The disintegration of lean manufacturing and lean management. *Business Horizons*, *62*(3), 359–371. https://doi.org/10.1016/j.bushor.2019.01.004

Shah, R., & Ward, P. T. (2003). Lean manufacturing: context, practice bundles, and performance. *Journal of Operations Management*, *21*(2), 129–149. https://doi.org/10.1016/S0272-6963(02)00108-0

Solaimani, S., Haghighi Talab, A., & van der Rhee, B. (2019). An integrative view on Lean innovation management. *Journal of Business Research*, *105*, 109–120. https://doi.org/10.1016/j.jbusres.2019.07.042

Stimec, A., & Grima, F. (2019). The impact of implementing continuous improvement upon stress within a Lean production framework. *International Journal of Production Research*, *57*(5), 1590–1605. https://doi.org/10.1080/00207543.2018.1494391

Thornton, K., Nath, N., Hu, Y., & Jia, J. (2019). Meaning, perceptions and use of lean – a New Zealand perspective. *Pacific Accounting Review*, *31*(4), 711–730. https://doi.org/10.1108/PAR-11-2017-0091

Tortorella, G., Nascimento, D., Caiado, R., Arrieta Posada, J. G., & Sawhney, R. (2019). How do different generations contribute to the development of a learning organization in companies undergoing a lean production implementation? *The Learning Organization*, *27*(2), 101–115. https://doi.org/10.1108/TLO-02-2019-0035

Valente, C. M., Sousa, P. S. A., & Moreira, M. R. A. (2019). Assessment of the Lean effect on business performance: the case of manufacturing SMEs. *Journal of Manufacturing Technology Management*, *31*(3), 501–523. https://doi.org/10.1108/JMTM-04-2019-0137

van Assen, M., & de Mast, J. (2019). Visual performance management as a fitness factor for Lean. *International Journal of Production Research*, *57*(1), 285–297. https://doi.org/10.1080/00207543.2018.1479545

Wickramasinghe, V., & Wickramasinghe, G. L. D. (2020). Effects of HRM practices, lean production practices and lean duration on performance. *The International Journal of Human Resource Management*, *31*(11), 1467–1512. https://doi.org/10.1080/09585192.2017.1407954

Womack, J. P., & Jones, D. T. (2003). *Lean thinking : banish waste and create wealth in your corporation* (1st Free Press ed., rev. and updated.). Free Press.

Závadská, Z., & Závadský, J. (2020). Quality managers and their future technological expectations related to Industry 4.0. *Total Quality Management & Business Excellence*, *31*(7–8), 717–741. https://doi.org/10.1080/14783363.2018.1444474