

Lean Supply Chain Overview and Impact of Lean Tools on Supply Chain and Human Resources – A Delphi Study

Ritesh Deore

Research Scholar, Department of Management
Birla Institute of Technology and Science, Pilani, India
riteshdeore19@gmail.com, p20210072@pilani.bits-pilani.ac.in

Shipra Pandey

Research Scholar, Department of Management
Birla Institute of Technology and Science, Pilani, India
Shiprapandey6@gmail.com, p20200042@pilani.bits-pilani.ac.in

Abstract

While considering the phenomenon of Productivity and Resource Efficiency, the first thing which comes to mind is the tools and techniques to achieve these parameters. One of those sets of tools is called lean tools and it helps in streamlining organizational processes. Lean supply chain is not limited exclusively to the companies who are into product manufacturing but for the businesses and firms whose focus is to eliminate waste and remove non value adding elements from the supply chain. In this paper, we are aiming at identifying the importance of lean tools and focusing on finding their significance in the day-to-day supply chain of the firms. We are also doing an overview of the impact of lean tools on the Human Resources of the firms. For this study purpose, we are using the Delphi technique with a lean-oriented survey to get insights from lean professionals.

Keywords

Lean Manufacturing, Lean Supply Chain, TPS, Toyota Production System and Lean HRM.

1. Introduction

Lean is an industrial phenomenon that enriches customer benefits by eliminating waste and continuously improving a system with the application of lean practices, techniques, and principles. The central attention on lean experiments and research was a single company with no extension to the complete chain of supply. The time when the lean terminology is tried across the complete supply chain, it is referred to as lean supply chain. The main purpose of such a study is to generate a structure from theoretical knowledge and practicing lean in supply chain management, which can increase understanding of the field. Lean in the supply chain as a supply chain management strategy aims at applying the lean concepts to the whole functions within the entire supply chain members: suppliers, local organizations, distributors, and customers. From the literature review and the case study, it is found that researchers and practitioners view lean in the supply chain as a transformation process in the entire process which results in a transformed and competitive phenomenon called the lean supply chain. Lean supply chain is linked to the benefits like improvement in quality, reduction in cost, improvement in delivery, higher flexible model, shortage reduction, etc. This is differentiated through a conventional supply chain with the attributes like long-term relationships with suppliers, efficient communication channel, information shared platform, integrated members, continuously improving nature, etc. These change and transforming benefits are related to the execution of lean practices and techniques in supply chain management. This cannot be done without rigorous and normal process flow in the execution of lean in the supply chain management. The selection and flow of execution of lean techniques depends on suitable situations, familiar nature, and preference. In terms of exploration of HRM practices, managers play a decisive role in implementation of these practices by providing adequate atmosphere to foster the commitment towards workforce (Benkarim and Imbeau, 2022). The key outcomes of the studies suggests that there is significant and positive relationship between Organization culture, Lean manufacturing and HRM as drivers of SCM and TQM, also these entities have affirmative association with process innovation (Arshad et al., 2020). Due to its focused areas, this study gives summarized understanding about lean in supply chain and its behavioral impact on the human

resources of the organization. The amount of clarity and process driven aspect brought by the lean tool in process functions is a key element of estimating the success of that firm and this study categorically identifies these aspects. Lean in HRM translates to creating a more efficient value for the client or customers by providing streamlined and defect free human resource interactions. Similarly, operational outputs can be effectively enhanced by implementing these lean practices. This study also identifies the lean tools and practices which are not widely popular and can create a great amount of impact if employees get trained on these tools. Thus, this study on lean can prove a good literature for the industry practitioners and academicians.

1.1 Objective

To study the impact of lean tools and techniques on supply chain and human resources of the organization by literature overview and survey. We are aiming to study different parameters and aspects of lean concept and their relative impact on supply chain and human resources.

2. Literature Review

2.1 Lean concept

The concept of lean was coined by Toyota Motors, Japan and it was known as TPS (Toyota Production System). Toyota Production System was first practiced by Taiichi Ohno, while trying to ensure the survival of the Toyota Motors post World War two economic crisis. Writers argued about the main objective of TPS has been to maintain continuous flow and eliminate waste. Continuously eliminating waste is desired to bring an increase performance effectively and reduce cost. TPS always underlies the way of production of only the required number of units of goods and in the right quantity required, hence avoiding wastage because of higher inventories and excess production. This remarkable thought by Taiichi Ohno on TPS failed to attract attention till the time of oil crisis of 1973, because to its effects few organizations closed business operations, but Toyota Motors kept operating and the business world was surprised by its ability and sustainability of greater earning through the oil crisis timeline. This process flow resulted in an exceptionally profitable performance by Toyota Motors, and got attention from different innovative people and who were keenly interested in what processes Toyota was following. In the year 1988, a researcher at MIT, USA coined the word “lean” to describe Toyota Production System, and he explained it as a system to make products with lesser defects and production was according to the requirements of the customer. In today’s world, lean practices are applied across various industries. There is no general or universally defined explanation of lean; instead, we have a variety of meanings of lean. However, in the process of describing lean as management and industrial philosophy which is related to identifying and eliminating waste from within and beyond the value chain. Lean is a flow to achieve a reduction in cost, improvement of quality, and efficiency increase with minimum efforts. There are four dimensions identified of practices of agile lean supply chain I.e., Virtual Integration, Process Integration, Customer Sensitivity, and Network Integration. (Routroy et al. 2018). Researchers Womack and Jones coined principal guidelines of the lean concept. Also proposed guiding principles related to the lean, which is termed as 4Ps model. There are also Toyota’s 14 management principles. Such 14 principles are the extension of the 4Ps model. The 4Ps model focused more on people-Partner relationship development than the five lean principles which are more comprehensive and centrally focused on main lean issues. Because of the comprehensive and unique way of the five principles, most of the authors concentrated on the discussion of lean practices. Consequently, whenever the lean principle is mentioned, the five lean principles are usually the first to flash on people’s minds. When we consider a virtual production line, the intermediate products must contribute to an optimized and balanced process flow. The goal of this optimization is timely, continuous, and reliable (Chu et al., 2021). As the study suggests organizations should invest in omnichannel lean strategies to grow their probability of sustainable business in terms of supply chain visibility, production cost, inventory, and sales (Trabucco and de Giovanni 2021). Talking about Human Resources Job Security, Communication, Fairness, supervisor assistance, training and development, occupational health and safety, and respect are seven key HRM practices in the context of Lean (Benkarim and Imbeau 2022). Lean thinking is described as a full power solution flow to counter waste. Studies from various nations have shown that selecting the right HRM practices allows for effective people management, which leads to improved organizational performance. HRM approaches encourage collaborative employee behavior, which reduces organizational barriers and boosts employee buy-in to Lean (Benkarim and Imbeau, 2022). The relationship between HRM practices and firm performance is moderated by lean production practices and operational performance; lean duration moderates the relationship between HRM practices and lean production practices in such a way that the longer the duration, the greater the adoption of lean production practices (Wickramasinghe and Wickramasinghe 2020). There are five key factors found relative to the HR domain for the institutionalization of lean production process are work design, Job related training, Knowledge sharing, Supervision

and Talent management (Nancy et al. 2022). Talking about leadership style impacts on lean, companies may be capable of performing identification of the phases of implementation in lean process which are poorly catered by Current styles of leadership, Problems anticipation and development of HRM practices to mitigate these issues (Tortorella and Fogliatto 2017). The 4P model is of strategic supply chain management is Purpose, People, Process and Performance.

- Womack articulated realistic business logic on lean practices.
 - Giving Specific benefits from a customer viewpoint.
 - Mapping value stream.
 - Establishment of flow.
 - Letting the customers pull the product/services.
 - To strive for desired zero error result.

2.2 Lean Principles

To implement lean principles through such executions or practices, some activities are performed to bring out improvement in the company or firm; the lean principles are seconded by following toolsets and practices.

- Source information on customer needs.
- Value stream analysis.
- Waste reduction/elimination.
- Workplace or system organization.
- Strong and effective relationship.
- Production of exact customer need only when needed.
- Problem search and solving.

2.3 Lean Practices and Tools

Practices and tools make a complete process flow on implementation of practices efficiently. Some of the known lean Practices and tools are:

- Just-in-time.
- Value Stream Mapping.
- Supplier Involvement/Integration.
- Standardization.
- Customer Involvement.
- Continuous Improvement / Kaizen.
- Root Cause Analysis (5Whys).
- Employee Involvement.
- Visual Control Management.
- Pull System and Kanban.
- 5S/Housekeeping.

In the process of execution of lean practices and tools; the choice of practices and tools to use first depends on the suitable situation and economic status.

2.4 The Concept of Supply Chain

“Supply chain management (SCM) is a continuously evolving management philosophy that seeks to unify the productive competencies and resources of the business functions found both, within the enterprise and outside in the firm’s allied business partners located along intersecting supply channels into a highly competitive, customer enriched supply system focused on developing innovative solutions and synchronizing the flow of marketplace products, services, and information to create unique individualized sources of customer value”.

2.5 Characteristics of Lean SCM

- Integrative Member of Organizational Supply Chain.
- Effective Information Sharing.
- Effective Demand Management.
- Focus on End-user/Customer.
- Continuous Improvement.
- Low Inventories with Few Suppliers.

- Continuous Flow and Long-term Contracts Between Supply Chain Members.

2.6 Benefits of Lean SCM

- Low Inventory.
- Customer Satisfaction.
- Optimized Efficiency.
- High Quality.
- Reduced Cost and Improved Delivery Time, Quantity and Quality Specifications.
- High Flexibility of Operations.

3. Methodology

To streamline the research direction, we conducted a Delphi study with one small survey with lean professionals. This survey helped us to focus on effective observations. Delphi technique is a well-structured method of communication developed as an interactive, systematic forecasting tool that relies on an expert panel. It has been used widely for business forecasting and has advantages over other structural forecasting approaches. We have followed 3 step process of Delphi where in the first step we identified and invited experts in our study area. In the second stage, we presented our questionnaire points to the experts and asked them to solicitate their ideas. During the third and decisive step we conducted the three rounds of idea rating and gathered insights after each round. Based on these inputs from our experts we numerically and graphically plotted the results to make them more inferential.

4. Data Collection

For our study, we have selected 20 experts who are lean practitioners in their respective fields of work. We have also performed article analysis with select articles on the topics of Lean Supply Chain and Lean in Human Resources.

4.1 Sample Questions asked in a Survey

1. How familiar are you with the term "Lean Practices"?
 - a. Just heard about it.
 - b. I worked on Lean projects.
 - c. Read about different Lean practices in Academics.
 - d. Saw a Lean process transformation happening.
 - e. No knowledge of this area.
2. When we think about Supply Chain Management, which company/Organization comes to your mind?
Ans: _____
3. From the following list, please select the practices of which you are aware.
 - a. Just-in-time (JIT).
 - b. Value stream mapping.
 - c. Supplier involvement/integration.
 - d. Standardization.
 - e. Customer involvement.
 - f. Continuous improvement/ Kaizen.
 - g. Root cause analysis (5Whys).
 - h. Employee involvement.
 - i. Visual control/management.
 - j. Pull system and Kanban.
 - k. 5S/housekeeping.
4. From the list below, please select practices that, according to you, can make the supply chain more efficient and leaner. (Select Max. 5 options).
 - a. Just-in-time (JIT).
 - b. Value stream mapping.
 - c. Supplier involvement/integration.

- d. Standardization.
 - e. Customer involvement.
 - f. Continuous improvement/ Kaizen.
 - g. Root cause analysis (5Whys).
 - h. Employee involvement.
 - i. Visual control/management.
 - j. Pull system and Kanban.
 - k. 5S/housekeeping.
5. Which of the following are very crucial factors in supply chain, which can be made more effective with lean practices? (Select max. 3 options).
- a. Distribution.
 - b. Warehousing.
 - c. Logistics.
 - d. Suppliers.
 - e. Customer.
 - f. Infrastructure. (IT and Physical).

5. Results and Discussions

The survey findings helped us to focus on several key areas of Lean practices. Based on the expert discussion and survey questions we have developed the traits and insights in this lean study. Following is the question wise observation and analysis:

1. The first question was asked just to test the knowledge level of respondent about the lean practices. We focused on professionals to fill in the survey and got the following observation (Figure 1)

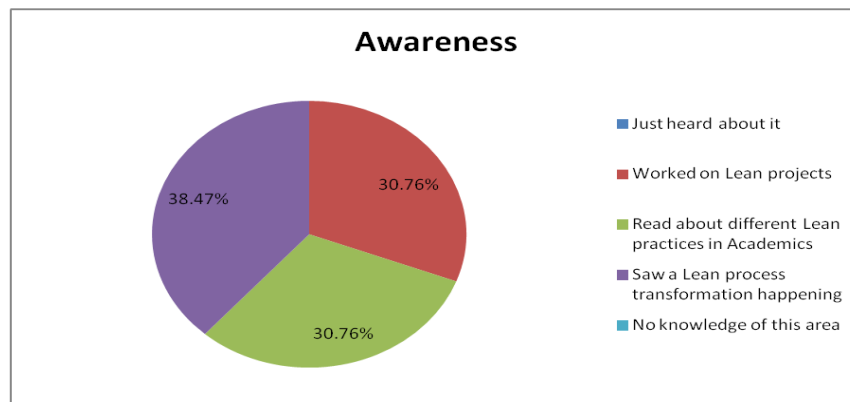


Figure 1. Awareness of Lean Concept

All the survey participants were aware of lean concepts and more than one third of them have seen an actual lean process transformation happening. Insights from these experts helped us gather the necessary results for the study.

2. The second question was asked to know about company/Organization that respondent see as a supply chain leader. Responses are (Figure 2):

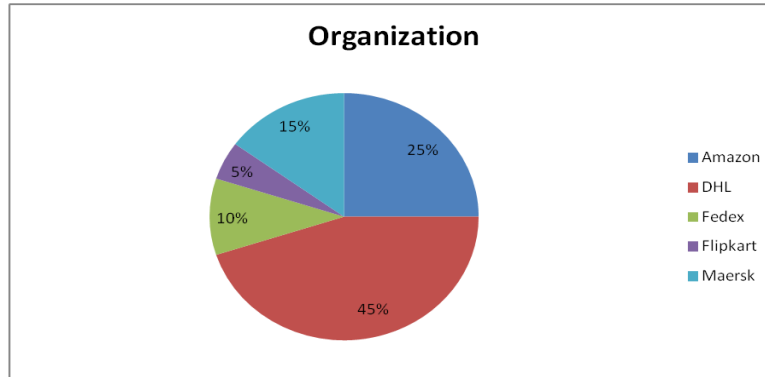


Figure 2. Supply Chain Industrial Leaders

In this area of study, DHL and Amazon were the most visible supply chain-oriented organization among the experts on lean.

3. Third Question was asked to know the familiarity of the respondent with the listed lean practices. Responses are (Figure 3)

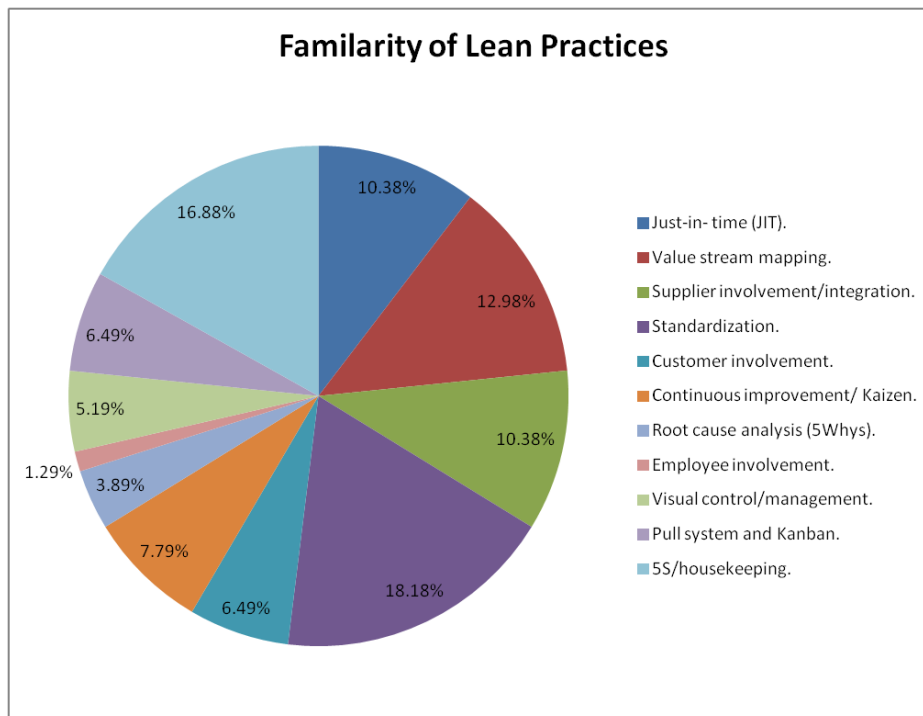


Figure 3. Familiarity of Lean Practices

In this aspect, Standardization and 5S are the most familiar lean practices across industries, whereas Employee Involvement and Customer Involvement carry the least familiarity.

4. Next question is asked to know which lean practices can be applied to supply chain domain. Responses are (Figure 4)

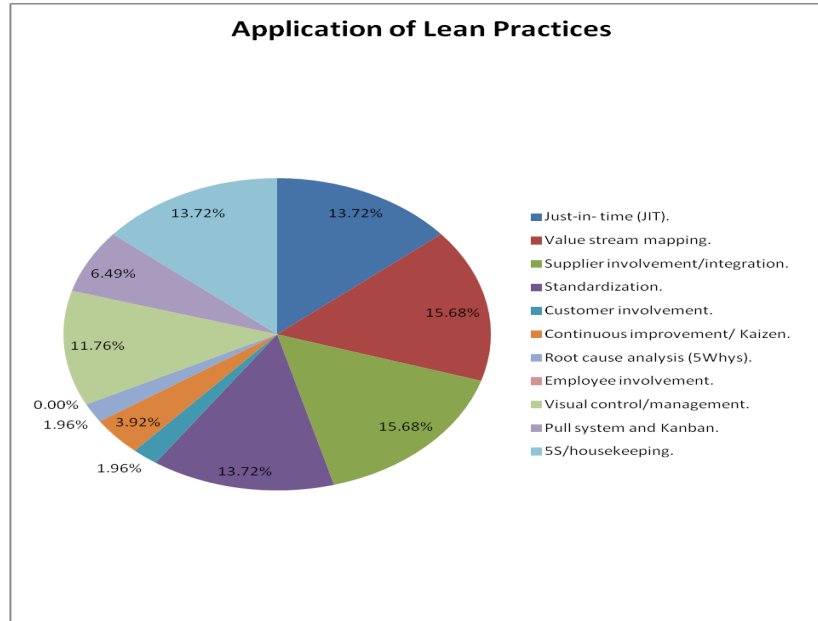


Figure 4. Application of Lean Practices

From application perspective, Value stream mapping and supplier integration are widely recognized and Root cause analysis and Customer involvement are least applied in industry.

5. This question is asked to know the crucial factors in supply chain while applying lean practices to this domain. Responses are (Figure 5):

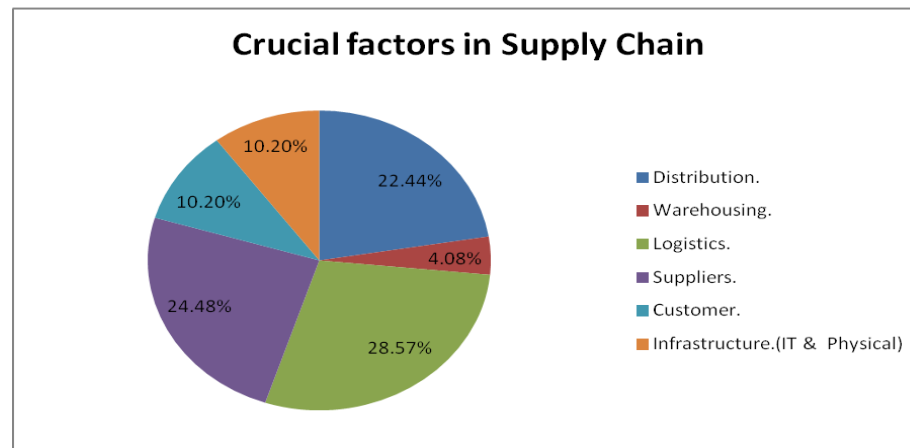


Figure 5. Crucial Factors of Supply Chain while implementing Lean Operations

Logistics and Suppliers are key crucial elements of Supply chain and warehousing is minor element when it comes to important to lean practices. A lean supply chain includes a value stream through the customers and suppliers must play strategic roles to achieve a lean production system. Planning, executing, and designing across multiple supply chain partners to deliver products of the right design, in the right quantity, at the right place, at the right time.

Supply chain management (SCM) is a continuously evolving management philosophy that seeks to unify the productive competencies and resources of the business functions found both. Finding a detailed process flow in lean is very tough as compared to other process improvement tools. Hence each touch point of the supply chain should be considered to map and plan the lean operations. Lean Supply Chain Practitioners can increase the external and

internal awareness, acceptance, and understanding of LSCM strategy with an aim of mutual efficiency improvement by triggering the adoption of an internal strategy by moving forward in a digital transition toward LSCM. (Núñez-Merino et al., 2020). As per the knowledge obtained from experts, logistical coordination plays a vital role in implementing a lean supply chain. Whereas, Value stream mapping is the area in which lean application can be proved crucial in obtaining better productivity. Talking about the impact on Human Resources, a lean tool makes the workforce more accuracy driven and brings better clarity to process-to-process operations. Human Resources are a source of competitive advantage, and HRM practices are critical to a company's transformation. Transitioning to Lean is more likely to fail if changes in business functions are not supported by changes in HRM practices. (Benkarim and Imbeau 2022). Though Lean tools and Practices have been used widely in the digital technology environment, they now can help stakeholders and managers to generate more value streams for customers. Also, a digital Lean Supply Chain that faces a risk is a scope for future experimental simulation research and optimization (Reyes et al., 2021). The Lean SCM implementation focuses on the regularity of the production demand and cost of production using low-cost raw materials and has standard quality (Ariadi et al. 2021). Lean production becomes "social lean production," in which people-centered HRM techniques are incorporated in WISEs' (Work Integration Social Enterprises) social mission and the unique qualities of human resources (e.g., in the case of employee involvement). Considerations such as institutional and market factors are also important (Signoretti and Sacchetti, 2020). The synergistic and complementary effect between Information and Digital Technology (IDT) of the industry 4.0 and Lean Supply Chain Management (LSCM) is strong and has an enormous impact on Supply Chain (Núñez-Merino et al. 2020). Lean Supply Chain System (SCS) improves financial performance with better optimization through a customer-integrated approach (Ariadi et al. 2021). In the effort of maximizing the positive effect of lean practices implementation on quality, organizations should focus on three aspects- Continuous quality improvement, Material flow management, and Waste management (Chakraborty and Gonzalez, 2018). Lean-driven sustainability tools have a great deal of untapped potential which is yet to be discovered. A more integrated approach in terms of channels and technology is needed to explore new horizons (Tasdemir and Gazo, 2018).

6. Conclusion

To conclude this paper, our study objective of gathering insights about lean in supply chain and to study its impact insights on human resources has been achieved and we have identified crucial factors influencing these lean operations in organizations. As per objective, we have listed down the focus areas for enhancing operations and human resource domains through lean practices. Further we are expanding this study into combining the lean benefits with the concepts of circular economy to develop a sustainable and green supply chain with lean functionalities.

References

- Ariadi, G., Surachman, Sumiati, and Rohman, F., The effect of lean and agile supply chain strategy on financial performance with mediating of strategic supplier integration and strategic customer integration: Evidence from bottled drinking-water industry in Indonesia. *Cogent Business and Management*, 8(1), 2021.
- Arshad Ali, A.; Mahmood, A.; Ikram, A.; Ahmad, A., Configuring the Drivers and Carriers of Process Innovation in Manufacturing Organizations. *J. Open Innov. Technol. Mark. Complex.*, 6, 154, 2020.
- Benkarim, A., and Imbeau, D., Exploring Lean HRM Practices in the Aerospace Industry. *Sustainability (Switzerland)*, 14(9), 2022.
- Chakraborty, S., and Gonzalez, J. A., An Integrated Lean Supply Chain Framework for U.S. Hospitals. *Operations and Supply Chain Management*, 11(2), 98–109, 2018.
- Chu, N., Nie, X., Xu, J., and Li, K., A systematic approach of lean supply chain management in shipbuilding. *SN Applied Sciences*, 3(5), 2021.
- Nancy Bouranta, Evangelos Psomas and Jiju Antony., Human factors involved in lean management: a systematic literature review, *Total Quality Management and Business Excellence*, 33:9-10, 1113-1145, 2022.
- Núñez-Merino, M., Maqueira-Marín, J. M., Moyano-Fuentes, J., and Martínez-Jurado, P. J., Information and digital technologies of Industry 4.0 and Lean supply chain management: a systematic literature review. *International Journal of Production Research*, 58(16), 5034–5061, 2020.
- Reyes, J., Mula, J., and Díaz-Madroñero, M., Development of a conceptual model for lean supply chain planning in industry 4.0: multidimensional analysis for operations management. *Production Planning and Control*, 2021.
- Routroy, S., Sharma, S., and Bhardwaj, A., Analysis of Agility Performance of Supply Chain: A Case Study on Indian Automotive Manufacturer. *IOP Conference Series: Materials Science and Engineering*, 346(1), 2018.

- Signoretto, A., and Sacchetti, S., Lean HRM practices in work integration social enterprises: Moving towards social lean production. Evidence from Italian case studies*. *Annals of Public and Cooperative Economics*, 91(4), 545–563, 2020.
- Tasdemir, C., and Gazo, R., A systematic literature review for better understanding of lean driven sustainability. *Sustainability (Switzerland)*, Vol. 10, Issue 7, 2018.
- Trabucco, M., and de Giovanni, P., Achieving resilience and business sustainability during COVID-19: The role of lean supply chain practices and digitalization. *Sustainability (Switzerland)*, 13(22), 2021.
- Tortorella, G. and Fogliatto, F., Implementation of lean manufacturing and situational leadership styles: An empirical study, *Leadership and Organization Development Journal*, Vol. 38 No. 7, pp. 946-968, 2017.
- Wickramasinghe, V., and Wickramasinghe, G. L. D., Effects of HRM practices, lean production practices and lean duration on performance. *International Journal of Human Resource Management*, 31(11), 1467–1512, 2020.

Biographies

Ritesh Deore is graduated in Electronics and Telecommunication Engineering from Pune University in 2015, earned his post-graduation in Management from Welingkar Institute of Management Development and Research, Mumbai in 2018 with Operations specialization, and currently pursuing PhD from BITS Pilani (Birla Institute of Technology and Science, Pilani). His research area is in the field of Circular Economy and Sustainable Supply Chain. He won the TCS Hackathon “DISQvery-2016” in the year 2016 held at Mumbai. He was the Chief Coordinator of IIT Bombay organized “National Robotics Championship-2014”. He has an industry experience of 4 years working with multiple MNCs in managerial positions.

Shipra Pandey is graduated in Business Administration from University of Lucknow in 2016, earned her post-graduation in Management from University of Lucknow in 2019 with Human Resource specialization, and currently pursuing PhD from BITS Pilani (Birla Institute of Technology and Science, Pilani). Her research areas include Sustainable HRM practices and Employee Well-being. She has qualified NET-JRF in Human Resource Management in the year 2019. She has presented her work at national and international conferences. She recently presented her study in international conference on “Wellbeing at Work 2022” held in Poland.