Impact of lean service, workplace environment, and social practices on the operational performance of India post service industry

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Abstract

This paper aims to study the determinants of the Lean Service System (LSS) on the Operational Performance (OP) of India's mail service in the National Sorting Hub (NSH), Mangaluru, Karnataka, the southern part of India. Measuring the OP in mail service is a big challenge in the postal service industry. Hence, we have conducted a survey, and 150 usable data has measured the impact of Lean Service Practices (LSP), Lean Workplace Environment Practices (LWEP), and Lean Social Practices (LSoP) on the OP. The results are analyzed from the partial least square based structural equation modelling (PLS-SEM) with the support of R programming. The analysis shows that there is positive and significant impact of LSP ($\beta=0.380$, $p<.05$), followed by LWEP ($\beta=0.281$, $p<.05$), and LSoP ($\beta=0.266$, $p<.05$) on OP. The practical effect of the findings of LSS are effectively implemented for enhancing the OP of the business. This research addresses the appropriate empirical model to test LSS in India's postal service industry, which is scant in the existing literature. Moreover, this study helps India Post to review its policy so as to sustain the effectiveness of Lean Service (LS) implementation.

Keywords Lean service practices (LSP) · Operational performance (OP) · Lean social practices (LSoP) · Lean workplace environment practices (LWEP) · PLS-SEM · Mail operations

Abbreviations

AM	Agile manufacturing
ANN	Artificial neural network
BWM	Best–worst method
DM	Decision makers
FGT	Focus group techniques
GDP	Gross domestic product
HFE	Human factors and ergonomics
I4T	Industry 4.0 technology

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ICHs	Intra circle hubs
JIT	Just in time
LM	Lean manufacturing
LMP	Lean manufacturing practices
LP	Lean practices
LPD	Lean product development
LPS	Lean production system
LS	Lean service
LSCM	Lean supply chain management
LSP	Lean service practices
LSS	Lean service system
LWEP	Lean workplace environment practices
MCDM	Multi-criteria decision making
MNOP	Mail network optimization project
NSH	National sorting hub
NVA	Non-value-added
OP	Operational performance
SC	Supply Chain
SEM	Structural equation modelling
SMEs	Small medium enterprises
SOP	Sustainable organisational performance
VSM	Value stream mapping

1 Introduction

Emerging technologies such as Industry 4.0 adopts cloud operations and artificial intelligence, and permits innovative and flexible production systems. Flexibility in manufacturing increases the ability of an organization to respond to consumer demands on time and increases the production system efficiency without sustaining unnecessary costs or utilization of excessive resources (Fragapane et al., 2020). Unpredictable or complex environments mostly exaggerate the manufacturing industries' operational performance and reliability. Thus, robustness is one of the most important metrics for assessing operational performance in the manufacturing industries (Chen et al., 2019).

In recent years, in both the academia and industrial sector, LM and Industry 4.0 are frequently used concepts for enhanced productivity and flexibility (Buer et al., 2018). Recently, Marodin et al. (2018) introduced lean implementation in the product development process, which is scant in the existing literature. Kamble et al. (2019) observed that LMP were a positive influence on SOP in Indian manufacturing companies. The present study also shows the significant direct and indirect effects of Industry 4.0 on SOP in the presence of LMP as a substantial mediating variable. Today, manufacturing industries are looking for LMP and environmental sustainability issues for competitive strategy. Bai et al. (2019) showed environmental and operational performance outcome while implementing lean system practices. LMP also discusses the triple bottom line approach such as economic, environmental, and social responsibility (Henao et al., 2019).

A study by Möldner et al. (2020) mentioned the process of innovation performance by incorporating LMP in manufacturing industries. The finding suggested that LMP has a medium effect on process innovation through the survey method. Abu et al. (2019)

incorporated LMP in the furniture industry, which dealt with motivations, barriers, challenges, and applications. Ghobakhloo and Azar (2018) examined LM, Agile Manufacturing (AM), and impact on business performance. Interestingly, LM contributed to OP, while AM improved financial and marketing performance.

Globally, the service sector contributes to more than 50% of the GDP of top economies (Anon, 2019). The service industry is exceptional compared with the manufacturing industry because of its heterogeneity, intangibility, simultaneity, inseparability, and perishability (Lovelock & Gummesson, 2004). Service organizations usually look demand that differs the entire day such as mail processing facilities, airline service, healthcare, and customer care (Bard et al., 2003). For example, mail processing facilities require process improvement because of rapidly varying challenges brought about by fast hi-tech growth, alteration in consumers' requirements, and growing liberalization of the market. Thus, postal industries are required to improve their strategy to enhance production and cost-effectiveness to survive in a competitive market (Borenstein et al., 2004).

The India Post service is governed by the Central Government of India, and comes under the public sector. It is an essential public utility and plays a significant role in socio-economic development. It utilizes all forms of transportation such as rail, road, air, and ship to transport its mail and parcels. Ineffective utilization of transportation can cause business interruptions and significant economic loss to a lean supply chain (Paul et al., 2019). It plays a vital role in providing social support through money transfer, payment of utility bills, mails, parcels, etc. Although such value-added services are available for the public, there is still a need to be fulfilled, as it should reach on time to the customers by increasing the delivery of articles in a day. It exploits the advantage of labour availability and has the widest network coverage in India.

In 2013, India Post introduced Hub & Spoke mechanism for Speed Post articles under the MNOP. Eighty-nine main centres of the country were selected as Speed Post hubs and named as NSHs, and 105 major centres within the postal circles were selected and named as ICHs. The NSHs are responsible for dispatching inward mails to connected delivery post offices (spokes), and the same lines can send outward mails to within and outside the circle. India Post has 23 postal circles, generated from post offices and ICHs connected to it. NSH Mangalore won the first position among the 89 NSHs in the country during 2012–2014 in the handling of speed post. It covers postal divisions such as Puttur, Mangaluru, and Udupi regions and deals with 15,000 speed post articles in a day. The position was based on the points made by the India Post software (Source: Mangalore first in handling speed post, The Hindu Magazine, Indian Postal Service, Dec. 22, 2012). However, the performance decreased due to the administration's revised target set for NSH Mangalore (25,000-Speed Post articles a day) to increase the delivery of articles. Hence, in the present study, an attempt has been tried to increase the delivery of articles by assessing LSS performance in the postal service industry after lean incorporation. Many business organizations have incorporated LM strategies to respond rapidly to changing business conditions and to outdo the competition in recent years (Wu et al., 2016). The concern that has emerged in these businesses and organizations is the need to develop strategies to assess the performance of lean practices reliably.

1.1 Significance of the study

There are two main reasons why LS assessment is essential for the India Post service:

1. India Posts in a million items losing significantly 12% of volume and market share from 2004/05 to 2008/09. Also, customers have rated the India post having low reliability and earnings / In a million items, India Post has significantly lost 12% of volume and market share from 2004/05 to 2008/09. The customers have also rated India Post as having low reliability and earnings; and
2. The financial performance of India Post is low (– 27%) compared with other players like TNT, Singapore Post, and Deutsche Post concerning earnings before interest and tax report.

[as mentioned by MNOP conducted by McKensy (2010)].

1.2 Statement of the problem

1. Growing competition from the courier industry, rapid change in communication methods, customer loyalty, globalization, etc. are long-term challenges for the postal service to sustain in the market. Hence, a LS strategy and a non-traditional method will help to compete in the market.
2. The lengthy existing procedures/rules involved in the internal operations are time-consuming.
3. Standardization of operating procedure needs to be focused, because errors committed by the employees are on the high side (Ramachandran, 2011).
4. The working environment has cramped accommodation for its workers, with old and uncomfortable furniture, poor lighting, outdated tools, poor building infrastructure, shabby appearance, etc. Implementing LS through understanding the VSM current state and enhancing operational performance will improve the facility layout.
5. Customers of India Post are concerned about quality service with a high response in the shortest lead time. LS will improve productivity in the back-end operations by delivering mails to the addressee in the shortest lead time.
6. Improving physical working conditions such as lighting, ventilation facilities, ergonomic chairs, housekeeping, and quality culture in workplace will give an excellent public image, and improve OPs. LWEPs will help boost the postal system to a better working environment (Vadivel, 2015).

The present paper aims to examine LSS practices on OP in the NSH postal service by considering all the above factors. The paper is divided into seven main sections. Section 1 describes the introduction, significance of the study, problem statement. Section 2 deals with literature review and the formulation of research hypotheses. Section 3 presents the research methodology and the scale development of this process. Section 4 covers data analysis and the results. Section 5 deals with discussions, Sect. 6 covers the implications and conclusion of the study, and the final section sets forth the limitations and future recommendations for this research.

2 Literature review

2.1 Background study

The globally renowned 'lean concept' was stated by Womack and Jones in the book, "Machines that Changed the World". LM focuses on finding and eliminating NVA activities (waste) in a product or service organization to create value for customers. The wastes are known as "TIMWOODS" (Transport, Inventory, Motion, Waiting, Over-processing, Overproduction, Defects and underutilization of resources). This waste is something that customers do not wish to pay, and is known as Non-Value-added Activities (NVA). Most well-known leading manufacturing companies have progressively implemented LM concepts. The benefit of LM is the same or more output with lesser inputs, i.e., material, machinery, workforce, space, and time. A typical LM conserve less than half of the inventory required at hand and lesser defects, while producing better variety of goods (Womack & Jones, 1990). The LM techniques facilitate more production volume in numerous industries, particularly in automobile industries and their vendors.

According to Lewis (2000), "Lean is a set of management philosophies for increasing production to reduce wastes" (NVA). LM requires multi-skilled employees, leadership, employees' coordination and commitment, etc. Toyota Production System (TPS) is the starting point of lean practices in manufacturing, which was slowly improved to identify and remove the wastes in the process flow inside the companies (Womack & Jones, 1990).

Kiichiro Toyota, the founder of Toyota Motors, was immensely attracted by Henry Ford's mass production strategy. But, unfortunately, due to the economic situation in Japan after World War II, he was forced to adopt batch production instead of mass production of the vehicles (Dale et al., 2007). This situation helped Toyota build numerous model vehicles in a low volume by minimizing cost in shorter lead times. Thus, the LM concept helped produce high-quality cars at low prices of different models to satisfy customer needs (Dale et al., 2007). The LM goal of removing wastes in the process development contributed to product quality and created value to the customers.

2.2 Empirical investigation on lean manufacturing practices

Recent literature on LM empirically explored multifaced research areas such as sustainability with Industry 4.0, factory digitalization, product development cycle, process industries, human factors & ergonomics, workplace environmental factors, supply chain frameworks, etc. Figure 1 shows both academicians' and practitioners' contributions to this empirical study.

Kamble et al. (2020) empirically investigated LMP on SOP with the integrated effect of I4T in Indian manufacturing industries. For that purpose, they have collected the data from 205 managers, currently working in different streams. The results showed that the direct and indirect impact of I4T on SOP was significant and confirmed the presence of LMP as a strong mediating variable. Sajan et al. (2017) investigated the LMPs in SMEs and the SOPs. They collected data from 252 Indian manufacturing SMEs. The findings indicated that LMPs are positively linked to different performances of sustainability such as economic, environmental, and social performance. Helleno et al. (2017) integrated sustainability principles in LM to asses in Brazilian manufacturing process industries through three case studies. They have included economic, social environmental factors in VSM. By incorporating environmental and OP results by implementing LMPs in six manufacturing

Fig. 1 Recent empirical study on lean manufacturing contributors

organisations, Bai et al. (2019) addressed the decision problem. A novel MCDM model was used to evaluate the environmental sustainability indicators through a better selection of LMPs, empirically tested data. Jakhar et al. (2018) examined the relationship between lean and green in the manufacturing industry with sustainable SC. Results obtained by the use of the SEM method show that lean implementation has a positive impact on the implementation of sustainability practices for supplier selection and production, but has a negative impact on sustainability practices for delivery and logistics services.

Based on data from a cross-sectional survey of manufacturing companies using hierarchical multiple regression analysis, Buer et al. (2020) explored the relations between LM, factory digitalization, and OP. The recovery of the Indian manufacturing sectors from coronavirus after-effects has been studied by Sodhi (2020), and he recommended lean six sigma tools and techniques.

Marodin et al. (2018) applied LM concepts in product development processes. They investigated empirically moderating the role of LPD on LM's impacts on quality and inventory performance. The results showed that the effect of LM on quality performance was a positive association and inventory turnover moderated by LPD practices. Panwar et al. (2018) adopted LMP in process industries. The results revealed that LMP has positively associated with OP and reduction in defects. However, in the process industries context, pull production found a marginal impact on OP.

Vlachos and Siachou (2018) empirically investigated workplace factors affecting LP in a global company. The findings revealed that LP is affected by workplace factors. Four LP variables, such as continuous improvement, waste, ergonomics, and product quality, are associated only with organisational culture. Sakthi Nagaraj and Jeyapaul (2020) examined the relationship between HFE and LM through survey data from 168 industry-lean experts. The study also documented that HFE was positively related to LP, and cognitive factors have the least influence.

The framework was developed by Yadav et al. (2020) to improve the adoption of LM processes in developing countries. Shop-floor management, quality management, and

production strategy drivers were the most critical drivers for the LM system. Alhuraish et al. (2017) explored the comparative study on lean and six sigma critical success factors in industries. A road map was developed by Talib et al. (2020) to help DM to facilitate the successful implementation of the integrated JIT-LPs to improve the performance of the Indian manufacturing industries using BWM. Khalfallah and Lakhali (2020) empirically explored the link between LMPs, AM, and operational and financial performance in 205 Tunisian manufacturing firms. The results showed that, except for JIT production, LMP had a direct positive relationship with AM, (2) AM had a positive impact on OP, and (3) LMP did not seem to contribute directly to OP. However, when it was mediated through AM, this relationship is significant.

By questionnaire survey methodology, Jasti and Kurra (2017) empirically investigated the validity and reliability of current LSCM frameworks in the Indian manufacturing industry. It concluded that a new LSCM framework is needed to meet the requirements of the Indian manufacturing industry. Jasti and Kodali (2019) studied the LPS framework empirically on Indian manufacturing industries in various fields such as automotive, process, machinery and equipment, electronics and components, and textile and textile industries. Through the survey in that sector, they gathered 200 responses. This study concluded that the LPS framework helped any Indian manufacturing industry to achieve organizational goals.

2.3 Lean system implemented in service industries

Many works of literature have suggested that lean is implemented and assessed in different service sectors. For example, Alnajem et al. (2019), Hussain and Malik (2016), Agarwal et al. (2016), and Robinson et al. (2012) have implemented this study in different parts of a hospital such as emergency, cardiac catheterization laboratory, etc. Narayanamurthy et al. (2017) and Thomas et al. (2017) have implemented this in the higher educational institute sector to improve the course plan and to reduce absenteeism in class. Vlachos and Bogdanovic (2013) and Rauch et al. (2016) have implemented partial LS elements in a hotel to improve hospitality. Davidson (2014) and Procter and Radnor (2014) implemented lean in the public sector in the UK, to remove NVA and to improve the working system of public services. Table 1 shows a summary of the papers related to LS implemented in the service sectors.

2.4 Hypotheses development

2.4.1 Lean service practices (LSP) impact on operational performance

Firms are putting in efforts to improving service quality by incorporating Lean principles to increase profitability and customer goodwill. Lean in the service sector plays a significant role in increasing customers' value by offering services with higher quality and speeding-up the process by using lesser and right amount of resources (George & George, 2003). Initially, some features of a LSS were endorsed by Bowen and Youngdahl (1998) from the LMS. Gradually, LS implementation increased in healthcare, education, public services, hotel, financial and IT industries, etc.

Most of the literature shows that the applicability of Lean practices in service industries presented promising results. But it did not show a comprehensive set of LSP in the service industries, particularly in mail service operations. Such sets are required for Lean

Table 1 Lean service system applied to service industries

S. No.	Author(s) and year	Industry	Remarks
1	Alnajem et al. (2019)	Emergency department	They have identified and validated their results based-on experts' opinions on lean six main categories, such as human resources, patient relations, top management and leadership, supplier relations, processes, and Kaizen
2	Gijo and Antony (2019)	Information technology	The authors implemented LSS in the DMAIC method to decrease the complaint time from 12.5 to 8.5 h. The cost impact INR2.5 million indirectly financial savings projected
3	Narayanamurthy, et al. (2017)	Education institute	After implementing lean service (LS) in an educational institute, elective course work evaluation is considered. Interestingly, both batches found absenteeism, but Batch 2 was less number. Batch 1 has without LS whereas Batch 2 has with LS implementation
4	Thomas et al. (2017)	Higher education institute (HEI)	This study implemented Lean Six Sigma (LSS) in HEI's and focused primarily on the curriculum design on undergraduate engineering programs. The impact of LSS showed an improvement in teaching and learning methods
5	Hadid et al. (2016)	UK based service firms	This paper investigated the LS on operational and financial performances in UK service firms. The results indicated that LSPs, LSoPs have a positive impact on OP. Interaction effect both LSPs and LSoPs and they have a more positive effect on OP
6	Hussain and Malik (2016)	Hospital	They implemented LS in the UAE Healthcare system. The authors identified waste minimization in public and private hospitals
7	Rauch et al. (2016)	Hotel	Interestingly, the authors tried the lean management tool in the hospitality sector positively. Among the lean tools, they found that VSM, 5S tools are the most useful
8	Lameijer et al. (2016)	Financial industry	Through a qualitative case study of five companies and 25 interviewers were asked the impact of lean six sigma. The result showed that simplify the accounts to remove wastes and implementation should be gradual to incremental
9	Ibrahim et al. (2016)	Mail processing service, Malaysia	They implemented sustainable Kaizen activities for the enhancement of labour productivity in postal service. Leadership, process redesign, and SOP were correlated, but it does not influence on labour productivity
10	Agarwal et al. (2016)	Cardiac catheterization laboratory	After incorporating lean six sigma inside the lab, there is substantial improvement in physician downtime, turn-time, on-time physician arrival, on-time patient arrival, on-time start in the side
11	Hartono et al. (2015)	Book publisher	ISM technique was used to find the ten success variables defined in the lean supply chain in Anti Offset
12	Piercy and Rich (2009)	Call service center	The authors proposed the lean techniques to understand the basic VSM to eliminate wastes. They found a significant enhancement in quality and cost in the call service center

Table 1 (continued)

S. No.	Author(s) and year	Industry	Remarks
13	Wang and Chen (2010)	Banking sector	The authors implemented LSS DMAIC and TRIZ methodology in the banking sector. Reduced waiting time (WT) for opening account. Also, it changes business policies and infrastructure for sustainable performance. The impact of LSS cost saving around the US \$828,000
14	Robinson et al. (2012)	Healthcare sector	'SimLean' approach is developed through education, facilitation, and evaluation to improve patient service quality
15	Vlachos and Bogdanovic (2013)	European hotel industry	The authors conducted a Lean assessment in Small and Medium Hotels in 19 European countries. Seven VSM assessed, and each VSM technique, deducting and reducing NVA throughout the chain
16	Davidson et al. (2014)	UK ministry of defence	The authors tried to adopt a lean concept in the Ministry of Defence in the UK. The authors suggested three relevant propositions, such as waste, value flow, and pull system for the public sector
17	Procter and Radnor (2014)	UK public services	While implementing lean in the UK public sector they were unable to meet their target. Hence pressure developed to finish the target among the employees
18	Shamsuzzaman et al. (2018)	Telecom service sector	After incorporating LSS, the average order fulfillment lead time for sales orders (SO) decreased from 10.3 to 5.9 days, and VAS orders decreased from 1.5 to 0.5 days
19	Chen et al. (2020)	Agri-food industry	Various lean performance objectives were achieved through subject matter experts and mobilization methods by using AHP for the food supply chain
20	Nicholson and Pakgohar (2020)	UK university law college	The authors attempted to incorporate lean management principles in the law clinic process to reduce the source intensity and improve the educational value for the students

practitioners and scholars to know the impact of operational performance in the India Post service industry. The authors chose the most used service industries lean tools, and incorporated them in the mail service operations for improving operational performance and measured its impact.

Growing complications in the manufacturing or service environments and faster delivery of products or service with enhancing quality needs makes organizations often rethink their operations' strategy. Additionally, quality management practices play a role in improving OP for the firms' competitive advantage (Kaynak, 2003; Lagrosen & Lagrosen, 2005). Shah and Ward (2003) made an association of LSP with OP. Further, the authors suggested that an operational performance should be analyzed by considering relatively multi-dimensional practices to each dimension. Some empirical studies evaluated the relationship between LSP and OP items (Callen et al., 2000; Fullerton & McWatters, 2002; Ketokivi & Schroeder, 2004). Conventionally, operational performance is characterized by operations' strategy for competitive priorities (Narasimhan & Das, 2001).

According to Holweg (2007), LMP is an operational practice that creates value for the customers and eliminates waste with the spending resources. Khalfallah and Lakhal (2020) in an empirical study on Tunisian 205 manufacturing firms' LMP on operational performance showed that LMP contributed to operational performance through the mediation of agile manufacturing. The Lean assessment conducted by Ibrahim et al. (2020) on the Malaysian construction industry revealed a relationship between LMP and OP. LMP on Industry 4.0 adoption moderated the effect on operational performance according to the manufacturing firms. Particularly process-related technologies negatively moderated and product/service-related technologies positively moderated with OP (Tortorella et al. 2019).

In postal services, for improving the operational performance of the delivering mail articles, using the following strategies should be used:

- Optimize India Post's mail network from collection- to- delivery;
- Standardize processes with a focus on quality improvement and reduction in complexity; and
- Establish an effective performance management structure using key performance indicators (KPIs) and regular reviews.

Hence, the hypothesis is as follows:

Hypothesis H1a There is a positive and significant impact of Lean Service Practices (LSP) on Operational Performance (OP) in India Post service.

2.4.2 Impact of lean workplace environment practices (LWEPs) on operational performance

Globally, the workplace environment and its relationship to job satisfaction has been defined in different circumstances over the years. A Danish study proposed that an organization can grow its efficiency through improvement of the workplace environment (Buhai et al., 2008). Physical environmental conditions are essential while implementing Lean in an organization, especially for the manual sorting process. While incorporating Lean, employee involvement is a significant success factor that develops a healthy workplace environment (Ramachandran, 2011). Spector (1997) witnessed that most companies do not wish to pay attention to their workplace environment, affecting employee's performance.

Bakotic and Babic (2013) identified that workplace environment is a significant issue for job satisfaction.

Chandrasekhar (2011) reasoned that firms need to pay more attention to workplace improvement to enhance internal productivity through the organization's profit. For example, lighting source is essential in a specific sorting section for reading and sorting the mails through postal pin codes. Research also reveals that poor lighting causes poor job performance such as dim, high glare, and poor light in the specific sorting section (Hemp-hälä, & Eklund, 2012). Temperature also plays a vital role in the workplace environment as to how the human body attempts to keep an ideal temperature. Beshir et al. (1981) clarified that too much heat exposure significantly reduces the employee's performance within 30 min after exposure at 86°.

According to Ossama et al. (2006), indoor air quality is essential to a healthy, comfortable job for the employees. Some contaminants like dust and odours can form significant unpleasant feelings and discomfort leading to productivity loss as well as job performance. Presently, India Post is taking the necessary strategic actions to creating a better workplace environment such as postal appearance for more trustworthiness, reliable for customers, and improving the processing facilities for the betterment of postal employees. Murugesan et al. (2020) evaluated a postal facility layout design, as part of LSP in NSH Mangalore, wherein cost and workplace environment were the main criteria to enhance the articles delivery per day. Implementing 5S and standardize activities led to attaining a more efficient, cleaner, and tidier workplace. In some companies' workplace, Lean implementation was less successful because of less used activities as mentioned by Dieste et al. (2020). Hence, the following hypothesis is formulated:

Hypothesis H2a There is a positive and significant impact of Lean Workplace Environment Practices (LWEP) on Operational Performance (OP) in the India Post services.

2.4.3 Impact of lean social practices (LSoPs) on operational performance

Lean social practices (LSoP) helps human resource features. Abdou et al. (2006) showed that LSoP had a positive effect on OP in the manufacturing sector. For example, a multi-skill employee can handle simultaneous operations such as scanning and sorting during the bottleneck time. However, postal management has to give proper training, motivation, and employee empowerment to its employees. Therefore, management support is required for the employees for the rewarding system. In addition to this, Shah and Ward (2003), Cua et al. (2001), and Yasin et al. (2003) empirically tested LSoP and proved that it had positive impact on OP.

Interestingly, Tortorella et al. (2018) found a relationship between leadership style and LMP. While implementing LMP, different types of leadership styles are required. The study revealed that task orientation leaders were more interested in incorporating LMP than relation orientation leaders. A study conducted by Hernandez-Matias et al. (2019) in Spanish 202 manufacturing companies showed that Human-Related Lean Practices (HRLP) had a significant relationship with OP. By considering the above, the following hypothesis is formulated:

Hypothesis H3a There is a positive and significant impact of Lean Social Practices (LSoP) on Operational Performance (OP) in India Post service.

3 Research methodology

3.1 Scale development to measure OP in India post service

The LSS dimensions and its items were generated from existing literature and Focus Group Techniques (FGT). The face validity of the scale was done by an expert panel of the Postmaster General, Postal Manager, Quality Manager, Academic Professors, and Research Scholars. Three independent variables (LSP, LWEP, and LSoP) and one dependent variable (Operational Performance) were identified. The study survey comprised of numerous multi-item constructs.

1. LSP: Lean tools and techniques applied to production enhancement such as VSM, Cellular layout, facility layout change, etc. Eleven items of LSP items as proposed by Hadid and Mansouri (2014) were considered.
2. LWEP: It refers to workplace environment such as ventilation and noise control. The construct LWEP was measured using nine items as proposed by Gopang et al. (2017) from Occupational Health and Safety Measures (OHSM).
3. LSoP: It refers to human/social relationship activities such as employee engagement, employee involvement, and performance measurement system. To measure LSoP, nine items as developed by Yasin et al. (2003) were considered.
4. Operational Performance (OP): It refers to non-financial performance measures/activities. The operation performance was measured using eleven items as endorsed by Hadid and Mansouri (2014).

Briefly, the LSS dimensions included LSP, LWEP, LSoP, and OP. Most of the items were fully considered from existing literature, and few items were modified according to the postal service requirements. Previous researchers or academicians did not pay much attention to LWEP items on OP, which is essential for manual working firms such as postal services. Figure 2 shows the flow chart of the scale validation of the work.

3.2 Questionnaire design

The questionnaire used in this study consists of the constructs; 1. Lean Service Practices (LSPs), 2. Lean Workplace Environment Practices (LWEPs), 3. Lean Social Practices (LSoPs), and 4. Operational Performance (OP). Measures for these constructs have been adopted from earlier studies as mentioned. Items of these constructs have been measured using a 5-point Likert scale with weights strongly disagree as 1 to strongly agree as 5 and Neutral as 3.

3.3 Data collection approach

After lean implementation, data were collected from 163 postal employees through a survey method. Then, the valid 150 responses were selected for analysis purposes. The sampling plan is shown in Fig. 3.

Fig. 2 Scale validation process

4 Results and analysis

4.1 Statistical analysis

The theoretical model was analyzed by the PLS-SEM procedure with the support of R programming (please refer to “[Appendix](#)”). Since the value of Mardia’s coefficient is 173.59, which exceeds the cut-off value of 5, it indicates that the data is non-normal (Bentler, 2005), and the PLS-SEM technique fits well for the present study compared with the covariance-based SEM. Hair et al. (2011) and Ketchen (2013) had also suggested that the PLS-SEM can be used when the data points of the study were non-normal. Besides, the resampling method called bootstrapping with 5000 subsamples was used during model testing (Hair et al., 2011). The demographic details are given in Table 2.

Fig. 3 Sampling process

Table 2 Demographics details for the study (n = 150)

Profile of respondents	Public postal service	
	Frequency (n = 150)	Percent
<i>Gender</i>		
Female	30	20.0
Male	120	80.0
<i>Age</i>		
21–35	75	50.0
36–50	55	36.7
Above 51	20	13.3
<i>Education level</i>		
SSLC	35	23.3
Secondary education	30	20.0
Graduate	60	40.0
Post graduate	25	16.7
<i>Work experience</i>		
Less than 3 years	45	30.0
4–14	55	36.7
15–25	20	13.3
More than 25 years	30	20.0
<i>Employment type</i>		
Permanent	85	56.7
Temporary	65	43.3

4.2 Harman's single factor test of common method bias

4.2.1 Common method bias

The common method bias problem can be ruled out by conducting Harman's single factor test. For this, the exploratory factor analysis was conducted without the factor rotation. In the present study, the first factor extracted 34.46% of the variance, which was less than 50%, indicating the absence of a common method bias issue as suggested by Hair et al. (1998). Besides, the Variance Inflation Factor (VIF) value of each variable exceeded the cut-off value of 3, which again confirmed the absence of a common method bias problem (Kock, 2017).

4.3 Measurement model results

The measurement model results are shown in Table 3. Composite reliability (CR), convergent validity (AVE), item loadings, and variance inflation factor (VIF) are presented in Table 3. Similarly, Heterotrait-Monotrait Ratio (HTMT) used to assess the discriminant validity of the used constructs also presented in Table 3.

The standardized loadings of items in their matching constructs were significant at a 5% confidence level. But some items in LSP (i.e., 6, 8, 10, and 11), LWEP (i.e., 5, 6, and 9), LSOP (i.e., 2 and 4), and OP (i.e., 1, 5, and 6) had insignificant loadings on their corresponding constructs, and thus were detached from further analysis. However, the composite reliability (CR) of the study constructs surpassed the value of 0.7. It indicated the presence of internal consistency of the latent variables used in the study (Hair et al., 2011). Further, the existence of convergent validity was confirmed by the AVE value, which also exceeded the cut-off value of 0.5 indicating a good fit (Fornell & Larcker, 1981). Besides, the multi-collinearity problem was examined by observing the VIF values (Variance Inflation Factor), and all the constructs had a VIF value of less than 5, indicating that the study constructs were free from the multi-collinearity issue (Rogerson, 2001).

As suggested by Henseler et al. (2014), the existence of discriminant validity was estimated by the "Heterotrait-Monotrait Ratio" (HTMT), which is shown in Table 4, wherein the diagonal values represent the HTMT values of each construct. In addition, the values were below the cut-off value of 0.85, indicating the presence of discriminant validity. Overall, the present study presented adequate evidence for the presence of convergent and discriminant validity.

4.4 Testing the structural model

The standardized coefficient of each hypothesized relationship, along with its corresponding significance level, is shown in Table 5.

The results of the structural model analysis indicate that all the direct hypotheses (i.e., H_1 , H_2 , and H_3) are positive and statistically significant, and in line with the expected assumptions. The relationship concerning $LSPs \rightarrow OP$ was found to be positive and significant (i.e., $\beta = 0.330$, $p < .05$) for the samples. Moreover, the hypothesized relationships $LWEPs \rightarrow OP$ ($\beta = 0.281$, $p < .05$) and $LSOPs \rightarrow OP$ ($\beta = 0.266$, $p < .05$) were also found to

Table 3 Measurement model results (item loadings, VIF, AVE and CR values)

Constructs	λ (> 0.5)	α (> 0.7)	AVE (> 0.5)	VIF (< 5)
<i>LSP</i>				
Value Stream Mapping	0.738**	0.845	0.562	2.793
Improving facility layout	0.720**			
Cellular layout	0.719**			
Single piece flow	0.716**			
Workload balancing	0.591**			
Reduce cycle time	0.728**			
5S	0.595**			
<i>LWEP</i>				
Lighting facilities	0.699**	0.849	0.624	3.077
Ventilation facilities	0.690**			
Visual Identification	0.759**			
Workspace	0.713**			
Drinking water facilities	0.660**			
Noise Control	0.646**			
<i>LSoP</i>				
Employee communication system	0.640**	0.867	0.597	2.498
Employee commitment	0.546**			
Leadership	0.792**			
Employee involvement	0.749**			
Multi skill task	0.727**			
Management support	0.726**			
Training	0.660**			
<i>OP</i>				
Improvement in production	0.512**	0.825	0.538	2.606
Improvement in employee performance	0.558**			
Employee understanding the process	0.744**			
Improvement in housekeeping	0.728**			
Reduction in Inventory	0.771**			
Reduction in cycle time	0.658**			
Reduction in human errors	0.632**			

** $p < .05$, λ loading, α composite reliability, AVE average variance extracted, VIF variance inflation factor

Table 4 Discriminant validity (heterotrait–monotrait ratio)

Constructs	1	2	3	4
1. LSP	1	.677	.680	.585
2. LWEP		1	.648	.773
3. LSOP			1	.668
4. OP				1

Table 5 Structural model results

Structural paths	Direct effects (standardized coefficients)		
	Estimate (β)	Percentile method (i.e. 95% significance level)	
		Lower bound (0.025)	Lower bound (0.975)
LSP→OP	0.330**	0.127	0.421
LSOP→OP	0.266**	0.066	0.562
LWEP→OP	0.281**	0.140	0.437

LSP lean service practice, LWEP lean workplace environment practice, LSOP lean social practice, OP operation performance, ** $\rightarrow p < .05$

Table 6 R square, Q square values, and GOF values

Dependent factors	R ²	Q ²	GOF
Operation Performance	0.627	0.246	0.535

R²=Coefficient of determination, Q²=Predictive relevance, GOF goodness of fit

be positive and significant. The values of the goodness of fit (GoF), R square (R²), and Q square (Q²) of the model are shown in Table 6.

In the present study, the model has only one endogenous variable (i.e., operational performance), and the explained variance (R²) on it was 62.7%. Moreover, the predictive relevance of the model was estimated by the measure Q², and the value of Q² should be greater than zero as suggested by Hair et al. (2014). In this study, the value of Q² was 0.24 for operational performance. Thus, the model has good predictive relevance since the value of Q² exceeded zero. Moreover, the goodness of fit (i.e., evaluating the predicting global supremacy of the model) of the model was determined by using the formula:

$$Gof = \sqrt{AVE} * \sqrt{R^2} \quad (1)$$

Tenenhaus et al. (2005) suggested that if the GoF value of the model exceeded the limit of 0.36, then it was said to have good predictive power. In the present study, the model's GoF was 0.53, which designates that the present study model has good predictive power.

5 Discussions

In the present study, LSS practices (i.e., LSP, LWEP, and LSoP) have a significant and positive impact on OP in the India Post service. However, Lean Social Practices have low significant impact ($\beta=0.266, p < .05$) on OP compared with LSP and LWEP.

From Fig. 4, LSP was found to be statistically significant on OP. The result is in agreement with the findings of Hadid et al. (2016) and Arumugam et al. (2020) (see Table 7). With the top management of the postal service recognizing the significance of LS tools

Fig. 4 A path model of LSS and operational performance

and techniques, operational performance can be improved. The results of the present study reveal that manager and employee commitment for LSP can help the postal service improve production without disturbing the daily routine activities. Applicable LS elements were incorporated in the NSH and manual sorting centre, and waste was eliminated by taking suitable course of action. Here, the cellular approach (Nagare cell) was used to reduce the walking distance in the sorting section. Reduction in cycle time and employee shoulder pain was taken care of by installing a fixed scanner; 5S for housekeeping concepts for everything; everything in its place. Visual management for visualizing the objects in the workplace. Single piece flow was adopted for reducing backtracking of mails. Workload balancing was availed for maintaining load uniformity to all employees by using systematic scheduling and careful analysis. The impact of the change and adherence to the recommendations were monitored continuously. After twelve weeks, an audit of the effect was performed, and the following was observed. The cycle time had reduced by 15.13% from 371 s; flow speed had increased by 11.36% from 590, individual article processed per person had increased by 11.36% from 8620.

From Hypothesis H2, LWEP was a significant factor with OP. Earlier works of Ajala (2012) and Gopang et al. (2017) recommended that a postal workplace environmental performance can be enhanced by suitable Occupational Health and Safety Measures (OHSM), and showed LWEP modifications of light arrangements, provision of ventilation facilities, whitewashing the wall, improving visual identification by implementing 5S, posters, inspiring cleanliness quotes, providing drinking water facility, and provision of equipment. For enhancing the sorting process through ease of readability such as local mails, pin code tags visible by a blue background with white text were issued. For non-local mails, pin code tags were red background with white text. Focusing light was provided on the top of the sorting box to improve visual ergonomics. The workplace was made to look neat by separating the scanning, sorting, sealing, and parcel section with suitable tape marking provision. Now, the workplace environment looked pretty and aesthetic. In the scanning section, a moving scanner was used earlier for scanning the articles. From the interview, it was understood that the bulk of articles in a day made the employees uncomfortable, causing pain in the shoulder, elbow joints, and wrists. Hence, a new method of fixed scanning method was proposed, which reduced the cycle time by 23.62%, and reduced Muskelotical Disorder (MSD) problems for the future.

LSOP was also found to have a substantial effect on OP. This was bolstered by previous outcomes from Arumugam et al. (2020). After implementing Lean, activities such as employee

Table 7 Comparative study of lean system practices on manufacturing/service firms

Lean system practices	β value measures	Benchmark study	Decision	Industries
LSP—> OP	0.02–0.25	Hadid et al. (2016)	Positive, significant	99 UK service firms
LSOP—> OP	0.07–0.28			
LWEP—> SME's performance	0.38	Gopang et al. (2017)	Positive, significant	35 SMEs, Pakistan
LSP—> OP	0.796	Arumugam et al. (2020)	Positive, significant	455 automotive SMEs, India
LSOP—> OP	0.895			
LSP—> OP	0.330	Current study	Positive, significant	Postal service firm (NSH), India
LWEP—> OP	0.281			
LSOP—> OP	0.266			

involvement, engagement, and management support was more. Employee commitment to understanding the role of lean implementation was better. Lean incorporation improved multi-tasking, employee empowerment, and communication system. However, it was an incremental stage. The results showed that LSoP had a beta value (0.035), which was less compared with the value of Arumugam et al. (2020) as mentioned in Table 7. Specifically, the present study also concluded that LSoP needed more attention in terms of social practices among postal employees, i.e., communication improvement, employee involvement, and training requirement, and consistent performance measurement. The postal administration has to pay much attention to these significant and viable methods to improve social practices. It is therefore, recommended that postal authorities and policymakers should make efforts to implement LSoP effectively. NSH has to perform these crucial parameters to compete locally and globally and implement complete LSS practices for the sustainable development of the country's economic position.

6 Implications of the study

The practical purpose of the present study was to provide enterprises wishing to develop their operations with a clearer understanding of specific LSS procedures that can be implemented in their service firms. The management team can also use the study results as a self-diagnostic method to evaluate and recognize areas in their current LSS practices in relation to OP, and the clear changes required. The result revealed that LSS practices in the form of LSP, LWEP, and LSoP are positively significant with OP. LSP has the most reliable beta coefficient from the sample done in the postal service, followed by LWEP, and LSoP. This implies that for any technical breakthrough or progress to be made, top management dedication and support for LSS is crucial. Leadership oriented strategy in the workplace and social practices are vital for a sharp corporate postal image.

The present empirical study examines the association within the postal service between the three LSS practices and OP. The research offers some initial proof that these activities can help businesses achieve competitive advantage through a higher degree of creative capability. The research confirms, given the theoretical and empirical support, that LSS practices can be fully conceptualized as governing the occurrence and effectiveness of OP in postal service firms. By studying the various dimensions of LSS, both researchers and practitioners can understand how the different items of LSS can contribute to OP. In enterprises view, LSS activities as a beneficial part of their corporate strategy and offer full support to the initiatives, it can positively affect future successes. The strength of the impact of LSS practices on OP is based purely on how well the postal sector implements or continuously sustains the process. Finally, the Indian postal department agrees that LSS is a technological, social, and workplace environmental improved method that requires additional policies and procedures for sustainable development. In fact, in April 2018, NSH postal service spent INR 2 lakhs for this lean implementation and assessment. Thus, the practical implications of this study could be justified.

7 Conclusions

The present study aims to examine the significant positive impact of LSS practices on OP in India Post services. To respond, with these three hypotheses (H_1 , H_2 , H_3), The findings showed that LSP, LWEP, and LSoP have significant and positive impact on OP. LSP ($\beta=0.330$, $p < .05$) was the main element that strongly impacted on OP, followed by LWEP ($\beta=0.281$, $p < .05$) and LSoP ($\beta=0.266$, $p < .05$). The current research takes into account consequences for two viewpoints, for example, theoretical and managerial. From a theoretical perspective, the present work establishes and analyzes a conceptual model that suggests relationships between the postal firm's LSS practices and the OP introduced. Previous studies on LSS have observed the technical and social performance of lean implementation, but little attention has been given to workplace environmental practices. Furthermore, past operations' management literature focused the lean has technical and social practices, but very less on workplace environmental practices, and the present study has achieved that purpose for manual labor in the postal service.

7.1 Limitations of the research and future recommendations

Few limitations of the present research are highlighted as follows: Firstly, the study adopted the questionnaire method. It recommended that detailed field survey and interview methods might overcome the response bias. Secondly, the sample size was less. Thirdly, the study was analyzed using advanced SEM-ANN analysis to predict and enhance the results' reliability and validity. However, the present study was carried out in India Post and was limited as a case study. Hence, the outcomes of the present research represent a specific region only. LSS implementation in the postal service sector in an original methodology ensures maximum economic benefit for the postal administration. In the future, LSS can be analyzed to measure financial and organizational performances. This analysis can be further explored to the rest of the lean sets, which may depend on specific industries and countries.

Appendix

PLS-SEM - R Programming

```
library(plspm) #Libraries
library(haven)
OP_data=read_spss(file.choose()) # Data
OP_data
LSP=c(0,0,0,0)
LSOP=c(0,0,0,0) # Conceptual Model
LWEP=c(0,0,0,0)
OP=c(1,1,1,0)
OP_PATH=rbind(LSP,LSOP,LWEP,OP)
innerplot(OP_PATH)
colnames(OP_PATH)=rownames(OP_PATH)
OP_PATH
OP_blocks=list(1:8,9:15,16:21,24:31)
OP_modes=rep("A",4) # Binding the data and conceptual model
OP_pls=plspm(OP_data,OP_PATH, OP_blocks, modes=OP_modes,
             boot.val = TRUE, br=5000)
innerplot(OP_pls, what = "loadings")
outerplot(OP_pls)
summary(OP_pls) #To get results
```

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