Lean Six Sigma deployment in HR: enhancing business performance

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Abstract: Organisations grow and flourish because of the capability and expertise of their human resources (HR). HR is the central focus of an organisation, as it enhances the organisation's performance. Six Sigma, Lean, and Lean Six Sigma (LSS) are process improvement methodologies widely used by organisations. LSS approach is based on the synergy of Lean and Six Sigma and hence, increases process throughput and accuracy. The research provides diverse case studies of successful LSS deployment in HR. The case studies highlight various benefits of LSS deployment in HR, such as enhancing quality and consistency in services, reducing employee attrition, enhancing training effectiveness, improving quality of recruitment, managing talent acquisition, and reducing overall costs. Research develops various LSS deployment frameworks and also provides direction for future research.

Keywords: lean; Six Sigma; Lean Six Sigma; HRM; employee turnover; compensation and rewards; training; efficiency; effectiveness; recruitment.

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1 Introduction

As the competition is growing at a fast rate in the current business scenario, it becomes difficult for organisations to manage production and service costs, improve overall quality and productivity, and still enhance customer satisfaction. In this context, the popularity of Lean and Six Sigma has grown considerably because of their rapid

large-scale deployment as industry-recognised business improvement methods (Nonthaleerak and Hendry, 2006; Schroeder et al., 2008). For manufacturing as well as service organisations, Lean and Six Sigma convergence is considered as a vital business strategy to enhance the overall quality and productivity. The term 'Lean Six Sigma' (LSS) coined by George (2002b) has gained wide acceptance among practitioners as LSS creates great synergy by integrating Lean and Six Sigma practices (Furterer, 2016; Shah et al., 2008). According to Snee (2010), LSS is a robust methodology that boosts process performance and hence, increases customer satisfaction and enhances bottom-line results of the business.

LSS facilitates employee empowerment and thus builds synergies for process improvements (Sunder, 2016b; Higgins, 2005). LSS provides superior results, as it is a better tool than either Lean or Six Sigma deployed in isolation. Similarly, Six Sigma applied in isolation without Lean involves several tools for process improvement but lacks strategy or structure to guide the system (Pepper and Spedding, 2010). According to a research study of different transaction-based organisations in the service industry, for measuring preferences for process improvement tools, it was found that 98.8% of the LSS professionals (sample size: 85) preferred using LSS instead of Lean or Six Sigma separately (Sunder, 2013).

Human resources (HR) is a critical business function as it facilitates shaping organisational culture, raising employee engagement, and boosting managerial effectiveness. HR does provide services at various levels: operational, tactical, and strategic levels. And where there is such diverse scope of HR services, there's room for process improvement that can lead to more efficient and effective operations. LSS deployment in HR is one of such initiatives to improve HR processes for better performance and increase the satisfaction levels of their internal customers. The research explores the LSS approach and deploys its concepts to different HR practices. Research also emphasises the contribution of LSS practices in various HR processes, comprising of operational tasks, tactical tasks, and strategic tasks. The following research questions are being investigated:

- How LSS deployment in the HR function transforms traditional HR processes to build and sustain competitive advantages?
- What are the impacts of LSS deployment on operational, tactical, and strategic HR tasks and related activities?
- What are the issues inherent with LSS deployment in HR practices?

The research study is structured into eight sections. Following this introduction section, Section 2 presents a review of the literature on the role of Lean, Six Sigma, and LSS in enhancing business performance. Section 3 focuses on the deployment of Six Sigma in HR and provides various illustrations of Six Sigma deployment in HR. The deployment of Lean in HR is discussed in Section 4. The research methodology is the focus of Section 5 and develops various LSS deployment frameworks. Section 6 underscores the benefits of LSS in HR and provides various LSS deployment illustrations. Section 7 highlights the managerial implications and directions for future research. Section 8 summarises the conclusions in the last section.

2 Literature review

Owing to the increasing significance of HR, organisations need to build the underlying capabilities of HR for effective service delivery. Service capabilities are evaluated based on process performance, complexity management, and continuous improvement. Among these, the management of process performance is the most critical element for HR. For improving quality excellence, HR should provide consistency in operations by providing better services at lower costs. Hence, measuring and improving key performance indicators (KPI) become essential as it inculcates a process improvement culture. Six Sigma, Lean, and LSS are process improvement methods to enhance KPI.

Six Sigma emphasises process performance parameters that are very critical to quality (CTQ), and hence enables organisations to identify and eliminate failures or defects in business operations (Antony et al., 2008). Six Sigma measure defects and reduce it to 3.4 parts per million opportunities (PPMO) and hence Six Sigma improves product quality in the organisations (Lee et al., 2009; Chen and Lyu, 2009). Six Sigma is a business process improvement strategy and focuses on reducing process variation to improve quality (Kumar et al., 2008). Six Sigma focuses on customer needs as well as requirements; hence, it is aimed to enhance customer satisfaction on a sustainable basis (Seth and Rastogi, 2004).

Six Sigma also focuses on process variables that are CTQ and hence better manages issues affecting customer satisfaction (Snee, 2004). Six Sigma is a well-established statistical approach that may be used by organisations to reduce variation in the business process (Chakravorty, 2009; Naslund, 2008). The benefits of Six Sigma include lower costs in manufacturing and services, higher customer satisfaction, and ultimately improved bottom-line results (Drohomeretski et al., 2014; Manville et al., 2012). Six Sigma monitors problems of poor quality by decreasing large variation in processes and hence, creates robust products and processes. Thus Six Sigma approach is more suitable where process variations need to be reduced (Snee, 2010). Six Sigma projects will be more successful if tools of Lean methodology are deployed in Six Sigma implementation (Shah et al., 2008).

Six Sigma also supports the Lean deployment process by acting as one of the inputs in such a process (Hines et al., 2004). As Six Sigma is an integral part of the operational strategies, it fits well into the higher-level strategic Lean process (Hill et al., 2018). Six Sigma is a process improvement strategy to enhance the quality of products and services throughout their life cycle (Harry and Schroeder, 2000). Apart from manufacturing, Six Sigma has been applied in HR (Madhani, 2017a, 2018b), sales and marketing (Madhani, 2017b, 2018a, 2018d), supply chain (Madhani, 2016, 2020e), retail operations (Madhani, 2020b, 2020c, 2020d), BFSI sector (Madhani, 2018c) as well as in finance and accounting services (Madhani, 2020a, 2021). Six Sigma aims at solving the different problems of organisations by collecting data and then using advanced statistical analysis tools (George, 2003; Snee and Hoerl, 2007).

Although the Lean approach was first applied to manufacturing, it has also been used in services (Bowen and Youngdahl, 1998). The Lean applications in the services include many steps such as identify value, map the value stream, improve flow, eliminate waste, implement pull and drive for perfection (Gupta et al., 2016). Lean deployment in the services saves the customer time and provides exactly what, when, and where the customer wants (Womack and Jones, 2005). It is mainly because Lean requires less

human effort, less equipment, less time, and less space due to its focus on doing more with the less (Womack and Jones, 2003).

The goal of Lean is to accelerate the velocity of any process by reducing waste in all forms. Lean segregates value-added (VA) activities from non-value-added (NVA) activities to describe the root causes of wastes (George, 2003). Lean is normally applied in knowledge-based tasks to eliminate NVA activities (Bhasin and Burcher, 2006). Lean methodology focuses on identifying and eliminating the following wastes: transportation; inventory; motion; over-processing; overproduction; waiting; defects; underutilisation of people's creativity and environmental waste (Vinodh et al., 2011; Wong et al., 2014). Lean helps organisations in producing and delivering products and services at the lowest cost and as fast as possible (Antony, 2011). It is mainly because Lean methodology focuses on reducing lead times, inventories, cycle time, setup times, equipment downtime, scrap, rework, and other wastes to enhance the overall cost efficiency (Sharma, 2003; Pettersen, 2009). Although the Six Sigma approach involves sophisticated data-based statistical and analytical tools, Lean is a relatively simple and more practical approach (Salah et al., 2010). Lean focuses on the elimination of waste and enhancing throughput and efficiency; however, Six Sigma focuses on the removal of process variation and defects in quality (Gibbons et al., 2012). Although both Lean and Six Sigma differ in their approach, the goal of these methods seems to be alike (Andersson et al., 2006).

Lean methodology alone does not take advantage of the statistical tools and techniques offered by Six Sigma. Similarly, the Six Sigma approach alone does not contribute enough to increase process flow and reduce capital investments (George, 2002a). Lean methodology adopts a more knowledge-based approach to decrease waste and improve productivity; however, the Six Sigma approach typically uses statistical methods to solve problems (Snee and Hoerl, 2007). Although Motorola developed the Six Sigma approach in the 1980s, it was combined with Lean methodology only in the early 2000s (Linderman et al., 2003; Snee, 2010; Cherrafi et al., 2017). Lean deployment in organisations uses many tools and techniques for process improvement and include cause and effect (C&E) analysis, Kanban system, 5S, value stream mapping (VSM), etc. (Chen and Lyu, 2009; Thomas et al., 2008).

Although Lean and Six Sigma are considered separate approaches for process improvement, both complement each other and hence, systematically drive process performance. LSS presents an integrated framework for developing innovations (De Koning et al., 2008). LSS applies the tools and techniques of both Lean and Six Sigma and hence removes the disadvantage of each method (Imam et al., 2012). As LSS is based on Lean and Six Sigma integration, it provides powerful analysis and problem-solving tools for process improvement and performance enhancement in the organisations (Andersson et al., 2006; Thomas et al., 2015). LSS helps organisations in improving quality, decreasing variation, and removing waste (Furterer, 2016). By managing costs and enhancing value, LSS imparts competitive advantages to the organisations (Arnheiter and Maleyeff, 2005).

As a team-based and holistic approach, LSS requires commitment and dedication to detect inefficiency and control waste. Being a hybrid methodology, LSS overcomes the limitations of Lean by reducing process variations and defects. LSS is extensively used as a transformation tool for migrating discrete and functionally reactive service

organisations into cross-functional and proactive organisations (Corbett, 2011). The business world recognises the value and significance of LSS methodology as more than 70% of Fortune 500 companies across various services endorsed its importance (Antony, 2015).

LSS is a business improvement methodology that provides many benefits: minimise cost and invested capital, improve speed, customer satisfaction, and quality, and ultimately enhances shareholder value (Laureani and Antony, 2017; Akkucuk, 2014). LSS helps organisations in reducing production costs, solving problems quickly, and enhancing capability and the bottom-line (Lee and Wei, 2009; Antony et al., 2017). LSS provides a formal organisational infrastructure to create an environment where each individual is responsible for the quality and hence plays an important role in its implementation (Sony et al., 2019). Laureani et al. (2010) emphasised that a combination of Lean and Six Sigma can benefit not only the manufacturing but also service organisations. LSS has enjoyed significant success in service operations (Sunder, 2016a). It is clear from the literature review that little published literature exists on LSS deployment in HR practices. There is a strong need for such LSS deployment frameworks not only in HR processes but also in various HR tasks and activities. Hence, this research underscores the importance of LSS initiatives in the HR function and builds conceptual frameworks and theories that can be empirically tested.

3 Six Sigma deployment in HR

The function of HR has shifted from its traditional transactional role to a more crucial organisational function that caters to the requirements of the dynamic and competitive business world. The HR processes are non-core in nature but reflect and reinforce other underlying processes of an organisation. Hence, HR is adopting the Six Sigma approach to address the needs of a range of internal customers. Following are the various illustrations of successful Six Sigma deployment in HR:

1 HR resource centre at Dow Chemical saved $3.2 million (Linda, 2004).

2 HR practitioners at Ford Europe and Intel have notably enhanced their internal HR processes (Bhatnagar and Sharma, 2004).

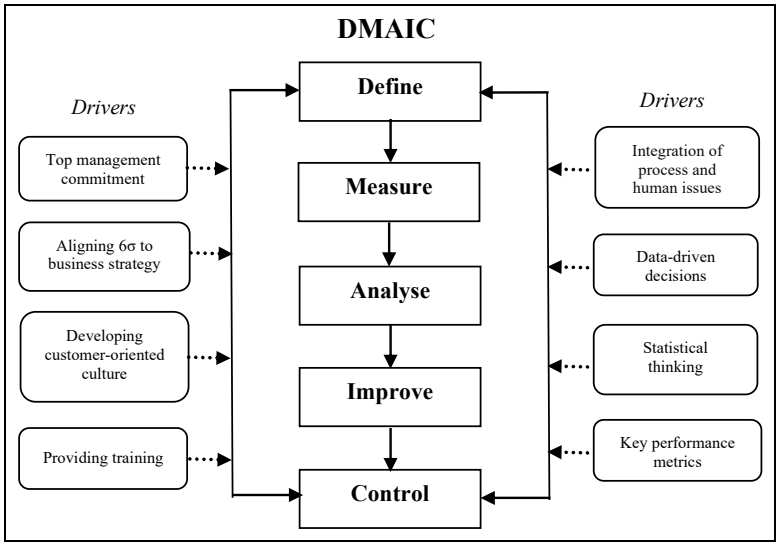
3 US defence contractor Raytheon has created customer value by making HRM processes more efficient, cost-effective, and user-friendly (Lanyon, 2003).

4 Hewitt Associates (now part of Aon) has solved the fundamental problems by thinking differently and increased employee retention (Leatherbury, 2008).

3.1 Six-Sigma DMAIC methodology

Various steps of the Six Sigma DMAIC methodology in HR, along with major facilitators of Six Sigma deployment are shown in Figure 1.

Figure 1 Six Sigma DMAIC methodology in HR



Source: Adapted from Madhani (2018c)

Six Sigma DMAIC stages are explained below:

1 *Define:* This stage defines the goals and internal customer requirements.

2 *Measure:* This stage measures the process to determine current performance.

3 *Analyse:* This stage analyses and determines the root cause(s) of the variability.

4 *Improve:* This stage improves the HR process by eliminating defects.

5 *Control:* This stage controls future process performance.

3.2 Six Sigma benefits in HR: various illustrations

With Six Sigma deployment, HR services stand to significantly benefit in terms of increased employee morale, better problem-solving approach, speedy delivery, decreased cost of poor quality, and superior reliability of services through the systematic decline of process variations (Madhani, 2022). The benefits of Six Sigma in HR are summarised below:

1 Six Sigma helps to reduce the time and cost of the recruitment process and also improves the quality of recruits.

2 Six Sigma reduces administrative errors and brings accuracy in preparing various compensation and benefits statements.

3 Six Sigma helps to reduce training costs and improve training effectiveness, increase employee satisfaction scores, and reduce employee attrition levels.

To highlight key advantages of the Six Sigma approach in HR practices, illustrations are taken from diverse areas such as service organisation, liquid crystal display (LCD) industry, banking sector, an engineering company, emergency services, and electronics industry. The following illustrations explain the Six Sigma approach in HR processes for service organisation (Globcorp), LCD industry (Taiwan-based firm in TFT-LCD industry), banking sector (Multinational Corporation – MNC Bank), an engineering company (Global Engineering Company), emergency services (Medical Emergency Organisation), and electronics industry (High-tech Electronics Company in China).

3.2.1 Globcorp

This illustration describes Six Sigma deployment in HR for managing talent attrition in the global corporation (pseudonym: Globcorp). At Globcorp, the HR function extends its services to more than 12,000 employees around the world. The company was delivering more than 450 processes, and hence, in 2001, Globcorp HR took Six Sigma initiatives intended to achieve 4.5 Sigma level. Globcorp HR was facing frequent incidents of salary payout delay, ineffective bench strength, and errors in headcounts. With Six Sigma deployment, transparency of Globcorp HR increased, bench strength reduced tofrom8% to 4%, attrition rate remained steady, and processing of backend HR activities and services became faster. The service level improved as the efficiency and effectiveness of the HR function increased. The mistakes in headcount also reduced from 8% to less than 1% (Bhatnagar and Pandey, 2005).

3.2.2 Taiwan-based firm in the TFT-LCD industry

This illustration explains Six Sigma deployment in the HR process for a Taiwan-based company founded in the middle of 1960. The company deployed Six Sigma in the HR process for a back-light module manufacturing unit in the TFT-LCD industry. The company was facing a high employee turnover rate. With Six Sigma deployment, the employee turnover rate drastically decreased from 43% to 15%. The company also achieved saving in recruitment costs, training costs, and internal failure costs (Lee et al., 2008).

3.2.3 MNC Bank

In 2003, Six Sigma was deployed in HR function at the Indian subsidiary of a MNC Bank where HR provided services to 1,200 employees in four business divisions. With the deployment of Six Sigma in the HR function, the bank accomplished process excellence as well as service excellence in operations, improved training effectiveness due to better alignment with organisational requirements, increased satisfaction level of internal customers with the HR function. LSS deployment in the MNC bank resulted in savings of US $1 million (Bhatnagar and Pandey, 2005).

3.2.4 Global Engineering Company

The Global Engineering Company employed 8,000 people in 20 different locations worldwide.

The company deployed Six Sigma in central HR function as HR was seen as reactive, uncoordinated, over-manned, and unprofessional. There was a need to improve HR

processes as it was delivering poor, slow, and non-cost-effective services. Six Sigma deployment by the company in HR function resulted in various benefits such as faster, efficient, and effective HR services, better internal customer satisfaction, increased motivation and job satisfaction of HR employees, and ultimately superior business performance. The employee costs in HR function decreased by 34%, the workforce requirement reduced by 15%, and decreased overhead cost by £250,000 (Wyper and Harrison, 2000).

3.2.5 Medical Emergency Organisation

This illustration explains the deployment of Six Sigma in an organisation operating in emergency services to reduce the high turnover rate (i.e., 12%) of doctors. To identify and eliminate the root causes of turnover in the Medical Emergency Organization, Six Sigma DMAIC Methodology was used. The root causes of high employee turnover were related to salary dissatisfaction and personal burnout. The organisation improved doctors' working conditions, enhanced pay, and provided working and social benefits. These actions resulted in higher net revenue by $0.84 million and achieved a steady rate of turnover between 0%–4% (Taner and Sezen, 2009).

3.2.6 High-tech Electronics Company in China

In 2011, High-tech Electronics Company in China was facing high churn rates among its 6,000 dispatched employees. It caused many problems related to production and also increased recruiting and training costs. The major causes of dispatched employee turnover were related to salary and benefits, the availability of opportunity for getting promoted to formal employee position (i.e., converting opportunity), and job hunting. Hence, the HR department deployed Six Sigma with support from production and quality units. The company proposed and implemented various steps such as job rotation, raising salary, offering converting opportunities, and providing training and career plans. With Six Sigma deployment in HR, the turnover rate of contract employees dropped to a weekly average of 1.4% (earlier it was 2.5%), recruiting and training costs declined, and production quality improved (He et al., 2014).

4 Lean deployment in HR

The eight types of waste in HR activities include – activities such as the handling of transactions more than required such as multiple levels of approval for release of an offer letter – 'transporting documents' (*transportation*); waiting for information or for someone to do something, documents pending approval for job offer and slow processing of retirement benefits – 'data, work-in-process, and completed services' (*inventory*); increased redundancy with double entry of employee benefits data, chasing for approvals, and searching for information of job candidates in separate systems – 'searching for information' (*motion*); waiting for review or work waiting for action such as transfer letters and promotion letters waiting to be signed and delays in overtime reporting – 'reviews and approvals' (*waiting*); producing HR reports that are no longer required, significant adjustments in reporting or repetition of data required on the same form –

'doing work not requested by customers' (*overproduction*); having unnecessary steps in the HR process, performing controls that are ineffective, unused reports, information sent automatically even when not required – 'processing itself' (*over-processing*); incorrect data entry and related errors in HR causing late completion – 'errors in data or documents' (*defects*); and insufficient training or work being performed by either HR people with no relevant skill set or too senior HR professional – 'under used skills' (*skills*).

4.1 Lean problem-solving techniques

There are various problem-solving techniques in the Lean environment to avoid waste: brainstorming, Ishikawa technique (C&E analysis), 5 Why, Seven Alternatives (7 Ways), Force Field Analysis, 8D (Eight Disciplines) Report, and A3 Reporting (Iuga and Rosca, 2017).

4.1.1 A3 reporting

Toyota used the A3 Reporting format as the template for problem-solving. This reporting format corresponds to the paper size of 11-inches by 17-inches or 29.7 cm × 42 cm. Following are eight different steps that comprise the A3 process:

1 recognise the problem

2 identify the existing state

3 build up the objective statement

4 execute root cause analysis

5 devise countermeasures

6 construct a countermeasures execution plan

7 verify outcome – validate the effect

8 revise standard work.

4.2 Lean benefits in HR: various illustrations

By eliminating wastes from HR processes, Lean deployment provides various benefits such as reduce recruitment cost and lead time, reduce new employee learning curve time, improve employee productivity levels, reduce overall employee cost, and reduce response time to employee queries. To highlight key advantages of the Lean approach in HR practices, illustrations are taken from diverse areas such as health technology, education sector, financial services, government organisation, and the healthcare sector. Benefits of Lean approach in HR processes for the health technology company (GE Healthcare), education sector (Coventry University – CU), financial services (Global Bank), government organisation (Statistics Norway), and healthcare sector (Spectrum Health) are explained in the next sub-sections.

4.2.1 GE Healthcare

In 2006, GE Healthcare adopted the Lean approach in the recruitment process. With Lean deployment, GE Healthcare experienced cultural shifts in its internal processes. In the past, GE Healthcare acquired many companies and hence faced issues of compliance, reporting, benchmarking, and standardisation. Hence, it caused huge inefficiencies in the recruitment process. GE Healthcare used the Lean tool – VSM for the recruitment process. After Lean deployment, GE Healthcare realised new heights of efficiency and quality in recruitment as hiring managers of GE Healthcare received better and more consistent service (Misko, 2010).

4.2.2 Coventry University

CU, UK deployed Lean methodology in a pilot project to improve the staff approval and recruitment process. VSM was used to deliver improvements in the recruitment process. The Lean recruitment project at CU resulted in a 54% reduction in lead time to process, approve and recruit a new member of staff (from 96 days to 44days), a 42% reduction in the time taken to add value within this process (from 6 days to 3.5 days) and a 20% reduction in overall time to approve and fill staff positions (Martin and Arokiam, 2008).

4.2.3 Global Bank

This illustration refers to Lean deployment in HR operations of an international bank. HR operations of a bank comprised of 3,000 employees. The Lean approach enhanced HR productivity, improved processes, and services, and achieved the planned cost reduction with process optimisation. Lean HR project was specifically focused on the following HR issues:

1 Job descriptions (JDs) mismatch

   With the Lean approach, total JDs were reduced because of standardisation. For a standard inventory of JDs, centralised management was implemented.

2 Over-service

   HR serviced all hiring requisitions submitted by businesses but later cancelled over 25% of hiring requisitions. To sort out this issue, each requisition was jointly assessed by HR and the hiring unit to make process standardisation for improved requisition coordination. This ultimately resulted in higher operational efficiency for recruiters.

3 False complexity

   Employee productivity was enhanced by 25% after the standardisation of tasks, as most compensation plans had only minor variations.

Lean HR initiatives at an international bank reduced operating costs by 20%, increased capacity improvement by 20%, and boosted internal service levels by 25% (https://thelabconsulting.com/wp-content/uploads/2017/10/Lean-Human-Resources-Process-Improvement-Transformation-Case-Study.pdf).

4.2.4 Statistics Norway

Statistics Norway, established in 1876, is the Norwegian statistics bureau. It prepares and publishes official statistics in Norway. Statistics Norway deployed the Lean approach in the following HR activities and found encouraging results:

1 training course management

2 recruitment

3 salary administration

4 participation of employees

5 enhanced internal management of HR.

In the area of training course management, Lean methodology at Statistics Norway resulted in more efficient use of training resources and fewer cancelled courses, and higher average participation per course (Byfuglien et al., 2012).

4.2.5 Spectrum health

Spectrum Health is a US-based integrated health service provider with 12 hospitals, 170 physician practices, and 23,000 employees. With ambulatory service sites and a health insurance company, it is one of the largest employers in Michigan State. To meet huge growth potential, Spectrum Health needs to fill 6,000 positions a year. To handle this demand efficiently and effectively, the talent acquisition team deployed Lean methodology in January 2013. With Lean deployment, time to fill a position was decreased by 10%; offer acceptance rate increased to 99.6% (from 96% earlier); turndowns decreased (fewer than 25 turndowns compared to 250 turndowns earlier); and customer and candidate satisfaction improved (above 90%) against industry benchmark of 80% (Van Duren et al., 2015).

5 Research methodology

Research builds the throughput-variability (T-V) framework (to understand how traditional HR practices are transformed with LSS deployment) and the operational-tactical-strategic (O-T-S) framework (to investigate how LSS enhances competitive advantages) to emphasise the roles of LSS in enhancing HR performance. These frameworks are explained in the next section.

5.1 LSS deployment in HR: the T-V framework

HR is a service department with internal customers (i.e., company employees), and hence the deployment of the LSS in HR enhances motivation and job satisfaction of employees. As shown with the T-V framework, the traditional HR practices are transformed with the LSS deployment in HR. Such conventional HR practices are characterised by processes with low throughput and high variability, while transformed HR processes show high throughput and less variability (Figure 2).

5.2 LSS deployment in HR: the O-T-S framework

In a study by the Hay Group (2013) looking at various roles in the HR department, the authors note that 95% of respondents said that the business strategy should form the basis for the HR strategy. The various tasks and activities of HR processes are explained in Table 1.

Table 1 HR processes: various tasks and activities

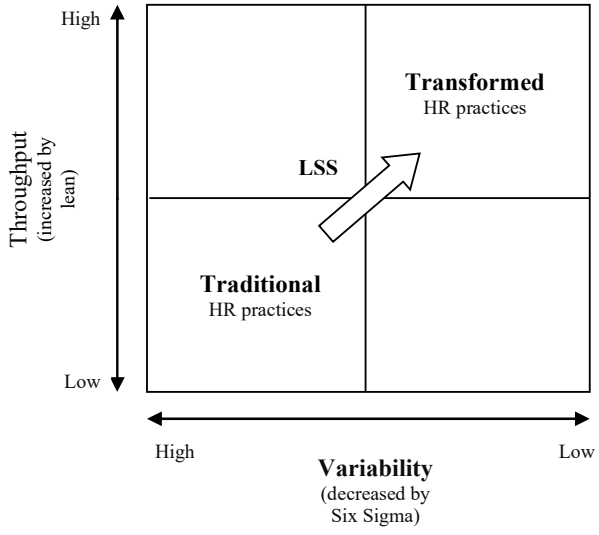
HR processes	*Task*		*Activity*
	Operational tasks (*unit HR*)	1	Payroll administration
		2	Transaction processing
		3	Salary and bonus administration
		4	Benefits administration and accounting
		5	Leave initiation and tracking
		6	Compliance administration
		7	Time and attendance
		8	Records management
		9	Performance evaluation
	Tactical tasks (*regional HR*)	1	Recruiting
		2	Employee relations
		3	Risk and compliance services
		4	Vendor management services
		5	Performance management
		6	Relocation and mobility services
		7	Learning and development
		8	Employee motivation
		9	Staffing and scheduling
	Strategic tasks (*corporate HR*)	1	Coordination of HR strategy with corporate strategy
		2	HR performance metrics
		3	Rewards, compensation and benefits policy/design
		4	Learning management strategy
		5	Performance management strategy
		6	Succession planning strategy
		7	Strategic workforce
		8	Planning and analytics
		9	Implementation and change management

Source: Tabulated by the author

Various tasks of HR processes are segregated as the operational task, tactical task, and strategic task. Figure 3 shows the O-T-S framework for implementing LSS in various HR tasks: operational tasks, tactical tasks, and strategic tasks. The O-T-S framework underscores how LSS implementation in HR builds competitive advantages.

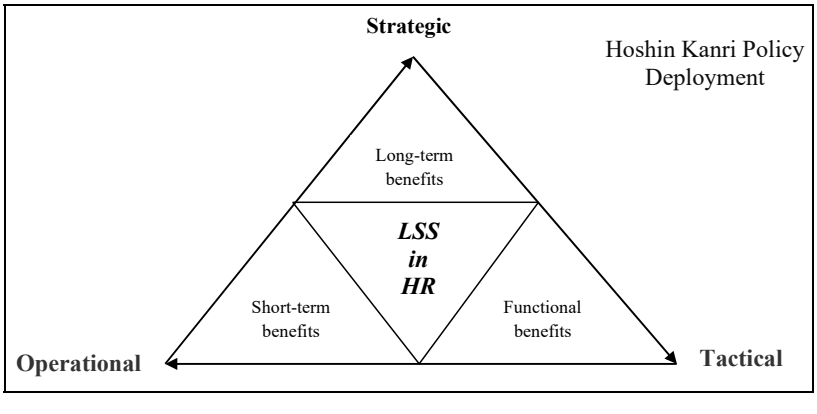
According to the O-T-S framework, LSS deployment is highly beneficial as it improves the performance of HR processes by positively influencing its various tasks and activities. The tasks of HR processes are categorised as operational (with short-term benefits), tactical (with functional benefits), and strategic (with long-term benefits). The role of HR depends on the activities it performs in each task and how it connects strategic, operational, and tactical tasks circularly.

Figure 2 The T-V framework: deploying LSS in HR



Source: Framework developed by the author

Figure 3 The O-T-S framework: deploying LSS in HR



Source: Framework developed by the author

5.3 Hoshin Kanri for Policy Deployment

The O-T-S framework (Figure 3) shows linkages between strategic, tactical, and operational tasks of HR processes. Hoshin Kanri offers a logical and organised

framework for policy deployment of such tasks and activities. Hoshin Kanri helps organisations in categorising and validating their priorities of HR processes (Table 1). As explained with the O-T-S framework, Hoshin Kanri provides help in strategic planning (strategic activities) and transforms strategies into medium-term plans (tactical activities) as well as short-term operations (operational activities). According to the Japanese language, Hoshin Kanri is translated as Hoshin (indicating the direction) and Kanri (supervision or control), and hence it is translated as policy implementation. Hoshin Kanri aligns top management objectives (strategic-level) with the middle management action plans (tactical-level) and the daily routine activities performed by the employees (operational-level). For effective implementation of Hoshin Kanri following ten steps must be sequenced (Akao, 1991):

1 setup a plan to emphasise quality policy and underline the company motto
2 establish various management strategies to incorporate medium and long-term outlooks
3 evaluate the information after collecting data
4 design the target
5 establish control items
6 use the control items
7 implement the policy plan
8 check the outcomes of the deployment
9 make a project status report for Hoshin Kanri deployment
10 standardisation of business processes or business fundamentals.

The above ten steps of Hoshin Kanri should ideally be implemented at the corporate level and cascaded across to divisions, then down through the individual operations (Tennant and Roberts, 2001). Hoshin Kanri offers a methodical approach to incorporate strategic management in day-to-day routine activities and hence proved very effective in promoting organisation-wide enhancement plans by binding the efforts of all employees of the organisation.

6 LSS benefits in HR: various illustrations

Six Sigma is a data-driven approach used for unknown causes of variation and focuses on decreasing process variations and defects (Laureani and Antony, 2017). However, Lean is a knowledge-driven approach used for known causes of waste and focuses on decreasing waste and boosting productivity. Figure 4 shows Lean and Six Sigma convergence on LSS deployment in HR.

With Lean and Six Sigma synergy, LSS deployment in HR services focuses on adding customers (i.e., internal customer or company employee) value by removing waste from service processes. Following are major benefits of LSS deployment in HR function:

1 Talent acquisition

   Improve the quality of recruits while decreasing the resources required for hiring.

2 Talent management

Develop JDs, provide effective training, and implement career development plans.

3 Compensation and benefits management

Develop a better response to employee queries.

4 Performance management

Establish and track performance appraisals, evaluation, and review processes.

5 Talent retention

Reduce employee churn by increasing satisfaction level and thus decrease the cost of managing employee separation.

6 Training

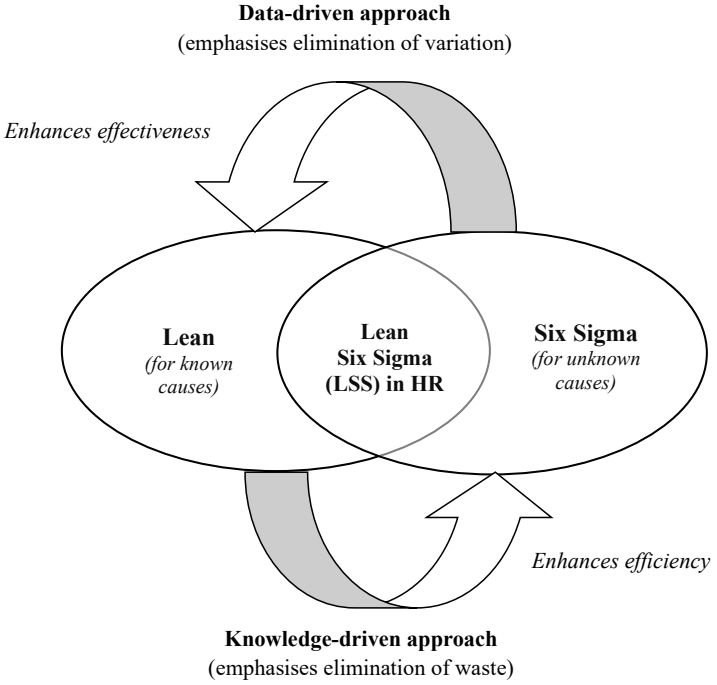
Reduce training cost and time; improve training effectiveness.

7 Administration

Streamlines and standardises the HR process; reduces administrative defects (e.g., payroll processing) and improves service levels for internal customers (internal employees).

To highlight key advantages of LSS deployment in HR practices, illustrations are taken from diverse sectors such as the mining and service sector. Benefits of LSS deployment in HR processes for the mining industry (Global Mining Company) and service sector (Service Sector MNC) are explained in the next sub-sections.

Figure 4 LSS deployment in HR: Lean and Six Sigma convergence



Source: Framework developed by the author

6.1 Global Mining Company

This illustration explains the deployment of LSS at a global mining company listed in the FTSE 100 index. Historically, the mining operations of the company were supported by separate HR teams with a narrow focus. The legacy approach caused many issues such as HR system failure, different roles, expertise, and service delivery of HR professionals, and the inability to identify and share internal HR best practices. The mining company faced the issues of standardisation and integration of its HR teams due to the implementation of a shared technology platform. With the deployment of LSS, HR teams were provided with a common approach through the HR toolkits. More than 500 links were established for the 93 activities of HR delivery to identify system failures as well as broken or incomplete processes. With the usage of the HR toolkits, HR functional costs decreased by 15% while the quality and consistency of HR support also increased (Higgins, 2007).

6.2 Service sector MNC

This illustration highlights LSS deployment in the HR area for a service sector MNC (multinational company). The LSS deployment aimed to reduce high employee turnover by increasing job satisfaction. The overall objective was to decrease employee turnover to 25% (corresponds to 250,000 DPMO). Out of 2,598 total employees of the company, 899 employees voluntarily left (i.e., 35% employee turnover). Therefore, a 35% employee turnover rate corresponds to 350,000 DPMO. After LSS deployment in HR, the overall companywide employee churning rate declined by 10% to 25%. By decreasing the employee turnover rate by 10%, the MNC saved $1.1 million (Laureani and Antony, 2010).

7 Managerial implications and directions for future research

Six Sigma makes use of statistical techniques and metrics, and hence, it relies on a small group of experts specifically trained for it. Six Sigma requires intensive training and a highly dedicated infrastructure; hence, for many employees, it becomes a barrier to an effective understanding. Hence, its adoption by the entire workforce is challenging. Lean focuses on continuous improvement and is often ad-hoc with little or no training. The full involvement and empowerment of the employees in a Lean initiative have the effect of improving employee motivation and engagement, which has positive effects on various relevant HR outcomes such as employee satisfaction, learning and development, and retention. This feature of Lean is also important to change management as well as the acceptance and sustainability of the process improvements. As Lean and Six Sigma go together and supplement each other, LSS culture plays a significant role in creating and sustaining improvements. LSS deployment in HR provides many capabilities and enhances the strengths of HR; however, the organisations working on LSS projects require a proactive approach of their employees to adopt LSS culture (Singh and Rathi, 2019). This viewpoint depends on various structural elements: change, communication, captain, consideration, and choosing a project. Hence, the successful deployment of LSS in HR requires the following 5Cs of HR (Sreedharan et al., 2020).

1 Captain

The captain shows commitment to the task and effectively communicates the HR policies.

2 Communication

For avoiding resistance to change, transparent and effective communications are required.

3 Consideration

HR is an important resource for the organisation. It has a huge effect on organisational performance, and hence, requires full consideration.

4 Choosing project

LSS project selection in the HR processes depends on the feasibility and ROI.

5 Change

LSS projects should manage the changes smoothly to reduce the probability of project failure.

LSS deployment in HR decreases the time and costs of hiring, training, and managing employee separation as well as reducing overtime and employee turnover costs. With LSS initiatives, traditional HR practices are transformed to represent various competitive capabilities. As explained earlier, T-V framework differentiates traditional HR practices and transformed HR practices. T-V framework emphasises that transformed HR practices are robust, proactive, and long-term and hence build competitive advantages. According to O-T-S framework, LSS deployment in HR function provides various functional benefits as well as short-term and long-term advantages.

The key findings of the research focus on the benefits of LSS deployment at various levels: strategic-level, tactical-level, and operational-level. HR practices at the strategic-level focus on building organisational culture and thus acts as a driver of employee retention. It also helps in attaining strategic objectives by improving HR processes. At the tactical-level, HR practices focus on various tasks such as HR staffing, training, and development, performance appraisal, and compensation practices. At the operational-level, HR practices focus on maintaining work-life balance and managing effective communication with employees while providing HR support.

As LSS is a change management tool, successful LSS deployment requires facilitating culture. Hence, there is a need to change the behaviour of employees, and the key facets of successful behaviour change are motivation and ability. Motivation requires the desire to do something, and ability requires the skills and support to do something. For a behaviour change to occur, both facets are important. With a sense of ownership and responsibility for behaviours inculcated among employees, LSS acts as a great enabler for employee engagement and empowerment in organisations. Future research may focus on the cultural change required for successful LSS deployment and identify the role of new hire orientation, leadership commitment and support, selection of projects, and organisation-wide training in building and supporting culture.

8 Conclusions

The deployment of Six Sigma, Lean, and LSS in HR functions provides many benefits. The research discusses and compares Six Sigma and Lean deployment in HR and provides various illustrations of their deployment in HR. The research emphasises that LSS deployment in HR is more efficient and effective compared to Lean or Six Sigma alone.

Various organisations have used LSS to streamline their diverse HR tasks, processes, and activities for sustaining operational performance and building competitive advantages. LSS deployment in HR transforms the overall processes and creates new capabilities for enhancing business performance. To highlight this transformation, the research provides illustrations of LSS deployment in the HR function.

The research illustrates in detail the successful LSS deployment in the following areas of HR:

1 enhancing employees' satisfaction by providing quality and consistency in HR services and support

2 reducing employee attrition

3 enhancing training effectiveness

4 improving efficiency and quality of recruitments

5 effectively managing talent acquisition

6 reducing overall HR functional costs.

LSS helps organisations to standardise and streamline HR processes (operational benefits), improve job satisfaction of internal customers or employees (tactical benefits), and offer ways to measure the performance of HR services in a structured way and hence change the organisation culture (strategic benefits). Thus, LSS deployment in HR builds long-term sustainable advantages. Research develops the T-V framework (to understand how traditional HR practices are transformed with LSS deployment) and the O-T-S framework (to investigate how LSS enhances competitive advantages) to emphasise the role of LSS in enhancing HR performance. The research also provides diverse case studies of LSS deployment in various HR practices of the organisations.

References

Akao, Y. (1991) *Hoshin Kanri: Policy Deployment for Successful TQM*, Productivity Press, Cambridge, MA.

Akkucuk, U. (2014) 'Application of Lean Six Sigma methodology in design and improvement of financial services', in *Globalization of Financial Institutions*, pp.151–164, Springer International Publishing, Switzerland.

Andersson, R., Eriksson, H. and Torstensson, H. (2006) 'Similarities and differences between TQM, Six Sigma and Lean', *The TQM Magazine*, Vol. 18, No. 3, pp.282–296.

Antony, J. (2011) 'Six Sigma vs Lean: some perspectives from leading academics and practitioners', *International Journal of Productivity and Performance Management*, Vol. 60, No. 2, pp.185–190.

Antony, J. (2015) 'Challenges in the deployment of LSS in the higher education sector', *International Journal of Productivity and Performance Management*, Vol. 64, No. 6, pp.893–899.

Antony, J., Kumar, M. and Labib, A. (2008) 'Gearing Six Sigma into UK manufacturing SMEs: results from a pilot study', *Journal of the Operational Research Society*, Vol. 59, No. 4, pp.482–493.

Antony, J., Snee, R. and Hoerl, R. (2017) 'Lean Six Sigma: yesterday, today and tomorrow', *International Journal of Quality & Reliability Management*, Vol. 34, No. 7, pp.1073–1093.

Arnheiter, E.D. and Maleyeff, J. (2005) 'Research and concepts: the integration of Lean management and Six Sigma', *The TQM Magazine*, Vol. 17, No. 1, pp.5–18.

Bhasin, S. and Burcher, P. (2006) 'Lean viewed as a philosophy', *Journal of Manufacturing Technology Management*, Vol. 17, No. 1, pp.56–72.

Bhatnagar, J. and Pandey, A. (2005)'HR metrics: HR Six Sigma in Indian organizations', *Management and Labour Studies*, Vol. 30, No. 4, pp.327–354.

Bhatnagar, J. and Sharma, A. (2004) 'Strategic HR roles in India: HR – dares to be the thinktank?', *Management & Labour Studies*, Vol. 29, No. 3, pp.153–172.

Bowen, E.D. and Youngdahl, E.W. (1998) 'Lean services: in defense of a production-line approach', *International Journal of Services Industry Management*, Vol. 9, No. 3, pp.207–225.

Byfuglien, J., Torstensen, H. and Trolie, A. (2012) 'The improvement of HR management by using Lean', *Proceedings of Human Resources Management and Training Seminars & Workshops*, pp.253–259.

Chakravorty, S.S. (2009) 'Six Sigma programs: an implementation model', *International Journal of Production Economics*, Vol. 119, No. 1, pp.1–16.

Chen, M.N. and Lyu, J. (2009) 'A Lean Six-Sigma approach to touch panel quality improvement', *Production Planning and Control*, Vol. 20, No. 5, pp.445–454.

Cherrafi, A., Elfezazi, S., Govindan, K., Garza-Reyes, J.A., Benhida, K. and Mokhlis, A. (2017) 'A framework for the integration of green and Lean Six Sigma for superior sustainability performance', *International Journal of Production Research*, Vol. 55, No. 15, pp.4481–4515.

Corbett, L.M. (2011) 'Lean Six Sigma: the contribution to business excellence', *International Journal of Lean Six Sigma*, Vol. 2, No. 2, pp.118–131.

De Koning, H., Does, R.J. and Bisgaard, S. (2008) 'Lean Six Sigma in financial services', *International Journal of Six Sigma and Competitive Advantage*, Vol. 4, No. 1, pp.1–17.

Drohomeretski, E., Gouvea da Costa, S.E., Pinheiro de Lima, E. and Garbuio, P.A.D.R. (2014) 'Lean, Six Sigma and Lean Six Sigma: an analysis based on operations strategy', *International Journal of Production Research*, Vol. 52, No. 3, pp.804–824.

Furterer, S.L. (2016) *Lean Six Sigma in Service: Applications and Case Studies*, CRC Press, New York, NY.

George, M.L. (2002a) *Lean Six Sigma: Combining Six Sigma Quality with Lean Speed*, 1st ed., pp.17–22, McGraw-Hill, Estados Unidos.

George, M.L. (2002b) *Lean Six Sigma for Service*, McGraw Hill, New York, NY.

George, M.L. (2003) *Lean Six Sigma for Service: How to Use Lean Speed & Six Sigma Quality to Improve Services and Transactions*, McGraw-Hill, New York, NY.

Gibbons, P.M., Kennedy, C., Burgess, S. and Godfrey, P.(2012) 'The development of a value improvement model for repetitive processes (VIM) combining Lean, Six Sigma and systems thinking', *International Journal of Lean Six Sigma*, Vol. 3, No. 4, pp.315–338.

Gupta, S., Sharma, M. and Sunder, M.V. (2016) 'Lean services: a systematic review', *International Journal of Productivity and Performance Management*, Vol. 65, No. 8, pp.1025–1056.

Harry, M. and Schroeder, R. (2000) *Six Sigma: The Breakthrough Management Strategy Revolutionising the World's Top Corporations*, Currency Publishers, NY, USA.

Hay Group (2013) *The Future of HR*, Hay.

He, Z., Zhang, X.T. and Zhang, M. (2014) 'Reducing the voluntary turnover rate of dispatched employees by the DMAIC process', *Total Quality Management & Business Excellence*, Vol. 25, Nos. 7/8, pp.842–855.

Hines, P., Holweg, M. and Rich, N. (2004) 'Learning to evolve: a review of contemporary lean thinking', *International Journal of Operations & Production Management*, Vol. 24, No. 10, pp.994–1011.

Higgins, K.T. (2005) 'Lean builds steam', *Food Engineering: The Magazine for Operations and Manufacturing Management*, pp.21–46.

Higgins, N.J. (2007) 'Putting Lean HR into practice: shifting the focus from cost reduction to operational excellence', *Strategic HR Review*, Vol. 6, No. 4, pp.16–19.

Hill, J., Thomas, A.J., Mason-Jones, R.K. and El-Kateb, S. (2018) 'The implementation of a Lean Six Sigma framework to enhance operational performance in an MRO facility', *Production & Manufacturing Research*, Vol. 6, No. 1, pp.26–48.

Imam, S., Tripathi, A. and Sarkar, S. (2012) 'Lean Sigma a road to success: a perspective of the Indian automobile industry', *Global Journal of Researches in Engineering*, Vol. 12, No. 1, pp.51–59.

Iuga, M.V. and Rosca, L.I. (2017) 'Comparison of problem solving tools in lean organizations', in *MATEC Web of Conferences*, Vol. 121, EDP Sciences.

Kumar, S., Wolfe, A.D. and Wolfe, K.A. (2008) 'Using Six Sigma DMAIC to improve credit initiation process in a financial services operation', *International Journal of Productivity and Performance Management*, Vol. 57, No. 8, pp.659–676.

Lanyon, S. (2003) 'At Raytheon six sigma works, too, to improve HR management processes', *Journal of Organizational Excellence*, Vol. 22, No. 4, pp.29–42.

Laureani, A. and Antony, J. (2010)'Reducing employees' turnover in transactional services: a Lean Six Sigma case study', *International Journal of Productivity and Performance Management*, Vol. 59, No. 7, pp.688–700.

Laureani, A. and Antony, J. (2017) 'Leadership and Lean Six Sigma: a systematic literature review', *Total Quality Management & Business Excellence*, Vol. 30, Nos. 1/2, pp.53–81.

Laureani, A., Antony, J. and Douglas, A. (2010) 'Lean Six Sigma in a call centre: a case study', *International Journal of Productivity and Performance Management*, Vol. 59, No. 8, pp.757–768.

Leatherbury, J. (2008) 'Talent show', *Quality Progress*, Vol. 41, No. 11, pp.48–55.

Lee, K.L. and Wei, C.C. (2009) 'Reducing mold changing time by implementing Lean Six Sigma', *Quality and Reliability Engineering International*, Vol. 26, No. 4, pp.387–395.

Lee, K.L., Wei, C.C. and Lee, H.H. (2009) 'Reducing exposed copper on annular rings in a PCB factory through implementation of a six sigma project', *Total Quality Management*, Vol. 20, No. 8, pp.863–876.

Lee, Y., Chen, L. and Chen, S. (2008) 'Application of Six Sigma methodology in human resources to reduce employee turnover rate–a case company of the TFT-LCD industry in Taiwan', *International Journal of Operations and Quantitative Management*, Vol. 14, No. 2, pp.117–128.

Linda, H. (2004) 'Six Sigma in sight', *HR Magazine*, Vol. 49, No. 3, p.78.

Linderman, K., Schroeder, R.G., Zaheer, S. and Choo, A.S. (2003) 'Six Sigma: a goal-theoretic perspective', *Journal of Operations Management*, Vol. 21, No. 2, pp.193–203.

Madhani, P.M. (2016) 'Application of Six Sigma in supply chain management: evaluation and measurement approach', *The IUP Journal of Supply Chain Management*, Vol. 13, No. 3, pp.34–53.

Madhani, P.M. (2017a) 'Six Sigma deployment in HR: enhancing competitiveness', *SCMS Journal of Indian Management*, Vol. 14, No. 2, pp.79–97.

Madhani, P.M. (2017b) 'Six Sigma deployment in sales and marketing: enhancing competitive advantages', *The IUP Journal of Business Strategy*, Vol. 14, No. 2, pp.40–63.

Madhani, P.M. (2018a) 'Six Sigma in sales and marketing: major benefits', *GITAM Journal of Management*, Vol. 16, No. 1, pp.21–31.

Madhani, P.M. (2018b) 'Enhancing HR competitiveness: a Six Sigma approach', *World at Work Journal*, Vol. 27, No. 2, pp.30–37.

Madhani, P.M. (2018c) 'Lean Six Sigma deployment in BFSI sector: synthesizing and developing customer value creation models', *International Journal of Electronic Customer Relationship Management*, Vol. 11, No. 3, pp.272–314.

Madhani, P.M. (2018d) 'Six Sigma in sales and marketing: enhancing competitiveness', *ASBM Journal of Management*, Vol. 11, No. 2, pp.57–64.

Madhani, P.M. (2020a) 'Lean Six Sigma deployment in finance and financial services: enhancing competitive advantages', *The IUP Journal of Operations Management*, Vol. 19, No. 3, pp.25–49.

Madhani, P.M. (2020b) 'Performance optimisation of retail industry: Lean Six Sigma approach', *ASBM Journal of Management*, Vol. 13, Nos. 1/2, pp.74–91.

Madhani, P.M. (2020c) 'Lean Six Sigma deployment in retail industry: enhancing competitive advantages', *The IUP Journal of Business Strategy*, Vol. 17, No. 3, pp.25–45.

Madhani, P.M. (2020d) 'Enhancing retailers' operations performance with Lean Six Sigma approach', *The Journal of Contemporary Management Research*, Vol. 14, No. 2, pp.1–25.

Madhani, P.M. (2020e) 'Enhancing supply chain efficiency and effectiveness with Lean Six Sigma approach', *International Journal of Project Management and Productivity Assessment*, Vol. 8, No. 1, pp.40–65.

Madhani, P.M. (2021) 'Lean Six Sigma in finance and accounting services for enhancing business performance', *International Journal of Service Science, Management, Engineering, and Technology*, Vol. 12, No. 6, forthcoming.

Madhani, P. M. (2022) 'Strategic HR: enhancing performance with Six Sigma approach', *Compensation & Benefits Review*, Vol. 54, No. 1, forthcoming.

Manville, G., Greatbanks, R., Krishnasamy, R. and Parker, D.W. (2012) 'Critical success factors for Lean Six Sigma programmes: a view from Middle management', *International Journal of Quality and Reliability Management*, Vol. 29, No. 1, pp.7–20.

Martin, S. and Arokiam, I. (2008) 'Investing to improve: organizational development and the link with Lean for continuous quality improvement', in *11th QMOD Conference, Quality Management and Organizational Development Attaining Sustainability from Organizational Excellence to Sustainable Excellence*, Helsingborg, Linköping University Electronic Press, Sweden, 20–22 August, No. 33, pp.99–108.

Misko, Z. (2010) 'Embracing a Lean culture: achieving operational excellence in recruitment through a proven manufacturing philosophy', *Workforce Management*, March, Vol. 89, No. 3, p.S4.

Naslund, D. (2008) 'Lean, Six Sigma and lean sigma: fads or real process improvement methods?', *Business Process Management Journal*, Vol. 14, No. 3, pp.269–287.

Nonthaleerak, P. and Hendry, L. (2006) 'Six Sigma: literature review and key future research areas', *International Journal of Six Sigma and Competitive Advantage*, Vol. 2, No. 2, pp.105–138.

Pepper, M.P.J. and Spedding, T.A. (2010) 'The evolution of Lean Six Sigma', *International Journal of Quality & Reliability Management*, Vol. 27, No. 2, pp. 138-155.

Pettersen, J. (2009) 'Defining lean production: some conceptual and practical issues', *The TQM Journal*, Vol. 21, No. 2, pp.127–142.

Salah, S., Rahim, A. and Carretero, J.A. (2010) 'The integration of Six Sigma and Lean management', *International Journal of Lean Six Sigma*, Vol. 1, No. 3, pp.249–274.

Schroeder, R.G., Linderman, K., Liedtke, C. and Choo, A.S. (2008) 'Six Sigma: definition and underlying theory', *Journal of Operations Management*, Vol. 26, No. 4, pp.536–554.

Seth, D. and Rastogi, S.C. (2004) *Global Management Solutions – Demystified*, Thomson Asia, Singapore.

Shah, R., Chandrasekaran, A. and Linderman, K. (2008) 'In pursuit of implementation patterns: the context of Lean and Six Sigma', *International Journal of Production Research*, Vol. 46, No. 23, pp.6679–6699.

Sharma, U. (2003)'Implementing Lean principles with the Six Sigma advantage: how a battery company realized significant improvements', *Journal of Organizational Excellence*, Vol. 22, No. 3, pp.43–52.

Singh, M. and Rathi, R. (2019) 'A structured review of Lean Six Sigma in various industrial sectors', *International Journal of Lean Six Sigma*, Vol. 10, No. 2, pp.622–664.

Snee, R. (2004) 'Six-Sigma: the evolution of 100 years of business improvement methodology', *International Journal of Six Sigma and Competitive Advantage*, Vol. 1, No. 1, pp.4–20.

Snee, R.D. (2010) 'Lean Six Sigma-getting better all the time', *International Journal of Lean Six Sigma*, Vol. 1, No. 1, pp.9–29.

Snee, R.D. and Hoerl, R.W. (2007) 'Integrating Lean and Six Sigma – a holistic approach', *Six Sigma Forum Magazine*, May, pp.15–21.

Sony, M., Naik, S. and Therisa, K.K. (2019) 'Why do organizations discontinue Lean Six Sigma initiatives?', *International Journal of Quality & Reliability Management*, Vol. 36, No. 3, pp.420–436.

Sreedharan, V.R., Balagopalan, A., Murale, V. and Arunprasad, P. (2020) 'Synergising Lean Six Sigma with human resource practices: evidence from literature arena', *Total Quality Management & Business Excellence*, Vol. 31, Nos. 5/6, pp.636–653.

Sunder, M.V. (2013) 'Synergies of Lean Six Sigma', *IUP Journal of Operations Management*, Vol. 12, No. 1, pp.21–31.

Sunder, M.V. (2016a) 'Lean Six Sigma in higher education institutions', *International Journal of Quality and Service Sciences*, Vol. 8, No. 2, pp.159–178.

Sunder, M.V. (2016b) 'Lean Six Sigma project management – a stakeholder management perspective', *The TQM Journal*, Vol. 28, No. 1, pp.132–150.

Taner, M.T. and Sezen, B. (2009) 'An application of Six Sigma methodology to turnover intentions in health care', *International Journal of Health Care Quality Assurance*, Vol. 22, No. 3, pp.252–265.

Tennant, C. and Roberts, P. (2001) 'Hoshin Kanri: a tool for Strategic Policy Deployment', *Knowledge and Process Management*, Vol. 8, No. 4, pp.262–269.

Thomas, A.J., Francis, M., Fisher, R. and Byard, P. (2015) 'Implementing Lean Six Sigma to overcome the production challenges in an aerospace company', *Production Planning and Control*, Vol. 27, Nos. 7–8, pp.591–603.

Thomas, A.J., Rowlands, H., Byard, P. and Rowland-Jones, R. (2008) 'Lean Six Sigma: an integrated strategy for manufacturing sustainability', *International Journal of Six Sigma and Competitive Advantage*, Vol. 4, No. 4, pp.333–354.

Van Duren, E., D'Amico, J. and Knoth, K. (2015) 'Lean talent acquisition: one team's journey of improvement', *Strategic HR Review*, Vol. 14, No. 5, pp.188–193.

Vinodh, S., Gautham, S.G. and Ramiya, R.A. (2011) 'Implementing lean sigma framework in an Indian automotive valves manufacturing organisation: a case study', *Production Planning and Control*, Vol. 22, No. 7, pp.708–722.

Womack, J.P. and Jones, D.T. (2003) *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York.

Womack, J.P. and Jones, D.T. (2005) 'Lean consumption', *Harvard Business Review*, Vol. 83, No. 3, pp.58–68.

Wong, W.P., Ignatius, J. and Soh, K.L. (2014) 'What is the leanness level of your organisation in lean transformation implementation? An integrated lean index using ANP approach', *Production Planning and Control*, Vol. 25, No. 4, pp.273–287.

Wyper, B. and Harrison, A. (2000) 'Deployment of Six Sigma methodology in human resource function: a case study', *Total Quality Management*, Vol. 11, Nos. 4/6, pp.720–727.

Websites

https://thelabconsulting.com/wp-content/uploads/2017/10/Lean-Human-Resources-Process-Improvement-Transformation-Case-Study.pdf