EMPIRICAL INVESTIGATION OF LEAN MANAGEMENT IN INDIAN SERVICE INDUSTRY

by

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(2012RBM9534)

Department of Management Studies

Submitted in fulfilment of the requirements for the award of the degree of

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EMPIRICAL INVESTIGATION OF LEAN MANAGEMENT IN INDIAN SERVICE INDUSTRY

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Under the Supervision of
Dr Monica Sharma

In fulfilment of the requirements for the award of the degree of

DOCTOR OF PHILOSOPHY

To the

Department of Management Studies
Malaviya National Institute of Technology
Jaipur, Rajasthan, India
September 2017

Dedicated to My Daughter

And

My Parents

DEPARTMENT OF MANAGEMENT STUDIES

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY
JAIPUR, RAJASTHAN-302017

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I **Shradha Gupta (2012RBM9534)** declare that this thesis titled "Empirical Investigation of Lean Management in Indian Service Industry". And the work presented in it is my own. The work has been carried out the supervision of Dr. Monica Sharma. I confirm that

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ABSTRACT

Presently, the world economy is being classified as a service economy as services have the highest sectoral contribution in global GDP. Growth in service sector is being taken as the indicator of country's economy progress. The pressure of competing in the global market & customer's demand of greater variety of high quality and low cost services has raised the importance of overall operational and service excellence for the service industries to sustain and compete globally. Aiming to perform in line with these changing needs, they are adopting various improvement methodologies. The service industry needs to accomplish consistent service excellence supported by continuous process improvement.

Since the beginning of this millennium, Lean has been widely acknowledged as one of the most impactful process improvement philosophies providing cutting edge to the service organisations through continuous process improvement, giving more for less, and aiming for higher customer satisfaction. In developing economies like India, lean initiatives are even more important as they enable organisations having limited resources to undertake not only process improvements but also lead to education & empowerment of employees and bringing improvement in working environment. Moving towards a Lean service is an organisation wide and long term endeavour. The central feature of such a mission is to have a model/framework guiding and directing the lean implementation. Present study is an attempt towards developing and validating such a framework for lean management in services.

The study identified 18 lean service frameworks from the literature review. These frameworks were empirically validated in selected Indian service sector using cross sectional survey. The need for comprehensive framework was established.

Further, the nine lean initiatives of lean services i.e. top management commitment, human resource and culture management, customer relationship management, elimination of waste, continuous process improvement, supplier management, information technology management, knowledge management and servicescapes were identified through literature review. These initiatives impact operational performance through waste reduction, cost reduction, improved resource utilisation, quality, delivery,

customer satisfaction, flexibility and innovation. Lean initiatives and operational performance effect business performance, which was measured in terms of impact on profits, market share, annual sales turnover and customer base.

Content validation of the conceptual framework was done through inputs of lean experts working in academia and corporate.

An empirical research using cross-sectional survey of lean practitioners and experts working in the field of Banking/Financial Service, Healthcare, IT/ITES and Telecom was conducted across India in order to validate the proposed Lean Service Framework. Exploratory Factor Analysis (EFA) was applied for dimension reduction and construct validity. Criterion validity of instrument was established using correlation analysis between lean initiatives and operational performance measures. Regression Analysis was used to test the hypotheses about the impact of lean constructs (individual predictors) on the performance measures (dependent variable).

The proposed framework will act as a guideline towards lean implementation in services. It will facilitate the practitioners/academicians/managers to comprehend clearly what comprises lean services and to appreciate the potential performance improvement through lean implementation in services. The framework might require customizations to suit the particular organisation requirements since all lean practices may not have the same level of requirement for implementation in a particular sector. The selection of lean practices and tools should be made carefully to suit the requirements of the organisation. Similarly, the ‘what’ of performance will remain the same but ‘how to’ measure it need to be adapted as per the type of services and need of the organisation.

The statistical validation was followed by case studies conducted in two service organisations which were at different stages of lean implementation. The first case study was done with the aim to verify the applicability of the proposed framework through identifying the level of implementation of lean initiatives proposed by the researcher in an Indian service organisation. The second case study was done to see the effect of lean practices adoption by Indian service organisation for improvement of quality of services, its delivery and their bottom line in an organisation in health care sector which had no previous experience in lean.

From the learning of literature review, research done, expert views, and case studies certain recommendations for implementation of lean initiatives in a service organization were derived which will act as the guidelines in their endeavour towards lean implementation.

The proposed framework has been tested in four Indian service sectors. Similar studies can further be taken across other service sectors which have not been covered in this one to validate the proposed framework. Similarly, future research can replicate the study in services industries outside of India.

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LIST OF ABBREVIATIONS

AHT	Average Handling Time
BWA	Broadband Wireless Access
BPMS	Business Process Management System
CAGR	Compound Annual Growth Rate
CBCA	complete blood count analysis
CMMI	Capability Maturity Model Integration
DMAIC	Define, Measure, Analyse, Improve and Control
EFA	Exploratory Factor Analysis
ENVA	Essential Non Value Added
FCR	First Call Resolution
FDI	Foreign Direct Investment
FMEA	Failure modes and effects analysis
GDP	Gross Domestic Product
HIS	Hospital Information System
ICT	Information and Communication Technologies
IMVP	International Motor Vehicle Program
IPD	In Patient Department
KMO	Kaiser-Meyer-Olkin
ISO	International Organization for Standardization
IT/ITES	Information Technology/ Information Technology Enabled Services
JCI	Joint Commission International
JIT	Just in Time
KPI	Key Performance Indicators
LTE	Long Term Evolution (a standard of 4G)
NABH	National Accredited Board of Hospitals
NFMP	Non-Financial Manufacturing Performances
NHS	National Health Service
NVA	Non Value Added
OPD	Out Patient Department
OT	Operation Theatre

PCA	Principal Component Analysis
PDCA	Plan Do Check Act
PVR	Performance Variance Reduction
QFD	Quality Function Deployment
RIE	Rapid Improvement Event
SEZ	Special economic zone
SLA	Service Level Agreement
SMED	Single-Minute Exchange of Dies
SOP	Standard Operating Procedures
SVSM	Service Value Stream Management
TAT	Turnaround time
TRAI	Telecom Regulatory Authority of India
TQM	Total Quality Management
VOC	Voice of Customer
VOE	Voice of Employee
VSM	Value Stream Mapping
WIP	Work in Process
WTO	World Trade organisation

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CHAPTER 1: INTRODUCTION

1.1 Overview

The business environment today is rapidly changing and the rate of change too is increasing. Facing with intensive global competition, rapidly shrinking product life cycles, shorter response time and highly demanding customers; organizations are now pursuing competitiveness by achieving higher level of product/service value and higher customer satisfaction. The quality of goods and services which satisfies customers, all contribute towards profitability. As an endeavour towards quality with different constraints, after the World War II, Toyota, under the guidance of Eiji Toyoda, Taiichi Ohno and Shigeo Shingo, created a management system with new approaches to problem solving, operations, logistics and customer support named as TPS (Toyota Production System) between 1948 and 1975. It was the foundation for the global movement which is called LEAN. The term “Lean“ was first coined by John Krafcik (former quality engineer in the Toyota-GM NUMMI joint venture in California) in his 1988 article, "Triumph of the Lean Production System," based on his master's thesis at the MIT Sloan School of Management. Krafcik's research was continued by the International Motor Vehicle Program (IMVP) at MIT, which produced the international best-selling book on lean methodology” The Machine That Changed the World” co-authored by Jim Womack, Daniel Jones, and Daniel Roos. Since then Lean has been generating a lot of interest among organisations in manufacturing as well as services.

Lean as defined by *National Institute of Standards and Technology* (USA) is a systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection. It strives to provide to the customer exactly what they want at specific price and at specific time. It endeavours organisations to rethink value from the viewpoint of the customer. A value-added activity is one that changes the size, shape, fit, form or function of material or information to satisfy the customer. From the perspective of customer "value" is any action or process that he would be willing to pay for; anything else is waste. Lean management is a systematic method to eliminate waste (Muda) in any processes. It also takes care of any waste generated through unevenness in workloads (Mura) and overburden (Muri). Lean thinking provides a way to do more with less – less human effort, less equipment, less time and less space (Womack & Jones, 1996). Walk through value stream enables people to have a system view and they learn to see the whole instead of only their part. The resultant clarity creates the foundation from which people can begin to understand what other people do and then identify where waste can be eliminated (Abdi et al., et al., 2006).

Continuous flow with pull from customer leads to double labour productivity all through the organisation with reduction in throughput time and inventory by 90 percent (Womack & Jones, 1996). It also helps in reduction in time to market and providing wider variety of new products/services at modest additional cost. It frees up the facilities and equipments too which reduces the capital invested. It helps in carefully analysing the optimum utilisation of limited resources to achieve the desired results in the best possible way. The lean methodology empowers employees by enabling a learning culture that encourages them to focus on sources of waste and improvement plans to eliminate them leading to continually improving all aspects of the organization. Lean management not only allows for organisational efficiency leading to cost advantage but also improves customers' convenience ultimately leading the organisation to achieve tremendous growth. Thus lean benefits organizations by changing their way of problem-solving capabilities and standardization (Hanna, 2007). Lean adoption induces increased competence of the employees, faster work completion, reduced frustration with improved customer satisfaction, and enables organizations to achieve financial benefits and competitive advantage with high quality, faster delivery time and delivery reliability (Petersson et al., 2015).

Manufacturing companies globally have been using lean initiatives since 1980s. One can read about the success stories of lean implementation of organisations like John Deere, Ingersoll Cutting Tool Company, TVS Motors, Sundaram Clayton etc. in literature. Adoption of lean is now no longer confined to manufacturing only and is being successfully being implemented in services too. Till date Lean has been successfully implemented in service industries such as banking, hospitals, software, call centres, education and public sectors.

1.2 Service Sector

Services play an important role in the global economy and the growth and development of countries. A service is a time-perishable, intangible experience performed for a customer acting in the role of a co-producer (Fitzsimmons & Fitzsimmons, 2006).The world economy is being classified as service economy because of the increasing share of services in developed and developing economies. The service sector has the highest sectoral contribution in global GDP with a share of 67.5 per cent in world GDP of US$70.2 trillion in 2011, as per UN National Account Statistics. It is the fastest growing sector globally providing employment to maximum number of people. In fact growth in service sector is taken as the indicator of country's economy progress. Service comprises sectors such as banking/financials, consultancy, healthcare, IT/ITES, communication, hospitality, education etc. Services have become critical for the development of country from achieving the basic goals of poverty eradication to providing water, health and education to all citizens to becoming a globally reckon force. Services are basically labour intensive and the incremental return on capital in services is more than in factories. New services are being floated each day to meet the customers' explicit and implied needs. Even the products today have the higher service component than in previous time necessitating the need to enhance the quality and value of services provided. George (2003) states that even within manufacturing companies, generally only 20 per cent of product prices are driven by direct manufacturing labour with the other 80 per cent coming from indirect costs associated with support functions, including finance, human resources, and marketing.

Service sector facilitate the production and distribution of goods, supporting other businesses in meeting their goals adding value to customers' lives. Supporting the other sectors, the service sector, mainly Information Technology and Knowledge Intensive Services, is being increasingly recognised as important forces for growth and development of the economy. Many services acts as key input to many other businesses like financial services, which provide access to finance for investment and facilitate transaction, health services leads to healthy workforce, IT/ITES provides technology support along with knowledge and information services. Thus service sectors are essential and have an extensive impact on business performance, growth and productivity of the economy as a whole.

The inherent characteristics of services like intangibility, simultaneity, perishability and presence of customers in production gives it a unique flavour as compared to manufacturing. Firstly, quality measurement in service settings is difficult because of intangibility of services thus many service organisations have failed to establish successful, formal quality control procedures. The recognition of need of quality improvement started with defect reduction and TQM. Secondly, it may also be difficult for the organization to understand how the customer perceives the quality in services (Parasuraman et al., 1985). Quality is the ability of the product or service to fulfil its intended purpose. In services quality is an experience. Quality in services is the extent of discrepancy between customer's expectations and their perceptions of service provided (Johnston, 1995). Customer expectation and satisfaction are highly subjective and difficult to measure. Thirdly, services have generally a large variability between different producers and different customers, because of customer involvement making it difficult to assure a uniform service delivery. Fourthly, the inseparable production and consumption of services means that the service cannot be manufactured in a manufacturing plant (Zeithaml, 1988). Instead, the service is usually greatly affected by the customer involvement, thus the service organization have less control over the quality (Parasuraman et al., 1985).

The need is to govern and respond to the service expectations of service users and training and motivating the service delivery workforce to interact positively with these users along with design of services for effective service management. The concept of co-creation needs to be linked to service operation management, integrating customer as an input being transformed into an output with some degree of satisfaction (Arfmann & Barbe, 2014; Damrath, 2012). Along with it services need to reduce service development life cycle, develop service mix aligning with strategic objectives making optimum utilisation of limited resources and large pool of cheap labour. The US Department of Labour, Bureau of Labour Statistics demonstrated that 'service sector productivity trails manufacturing by a wide margin' (May, 2005). Sustaining in the market is only possible by adopting approaches or methodologies like lean to improve processes, culture and mindset of people. Service industry can benefit from the application of lean philosophy through the increase of organizational competitiveness and customer satisfaction, and the reduction of process variability and wastes (Andrés-López et al., 2015). Using lean principles to improve the efficiency of services will certainly have massive impact on total economy, services being a major contributor in GDP.

1.3 Indian Service Sector

Service sector in India has emerged as one of the largest and fastest growing sectors in the world with annual growth rate of above 9% since 2001. The share of services in India's GDP at factor cost (at current prices) increased from 33.5 per cent in 1950-51 to 55.7 per cent in 2011-12 and to 56.9 per cent in 2012-13 (Prasad et al., 2014). India showed the second fastest service sector growth with a CAGR (Compound Annual Growth Rate) of 8.7% in period 2001-2013. As evident from the table 1.1 all the major economies of the world except China have service sector contribution greater than 50% in their GDP. Among the world's top 15 countries in terms of GDP, India ranked 10^{th} in terms of overall GDP and 11^{th} in terms of services GDP in 2013 (Government of India, 2014-15). During 2001-13 India was at the top among the top fifteen largest economies at 20.1 per cent followed by China at 16.5 per cent for the CAGR of world commercial services exports. For the top fifteen countries, except India and China, the shares of both services GDP and services employment are high and close to each other. Indian services sector has a high share in income and relatively low share in employment. But in both these countries, the shares of services in both GDP and employment have increased in the last twelve years. In 2014 India's services sector growth at 10.3% was noticeably higher than China at 8.0% (GOI, MOF). It contributed almost 66.1% of its gross value added growth in 2015-16 as per the economic survey (GOI, MOF).

The policy reforms in 1990s led to privatisation, removal of restrictions on FDI and streamlining of procedures of exports as well as imports. These lead to the emergence of service led "growth" in India. Indian service sector hasn't followed the traditional growth model. It has leaped from agricultural to service stage and has skipped the manufacturing stage. The service sector has contributed notably to exports, attracted significant foreign investment inflows, provided large-scale employment and been the leading and vibrant contributor to India's GDP. The main drivers of GDP growth have been mainly the communication services, and banking and insurance services and real estate (Das & Raut, 2014).

Table 1-1: Performance in Services : International Comparison (Government of India, 2014-15)

Country	Rank in GDP		Services growth rate			Share of services						Services export growth		
	Over all	Ser- vices	(per cent) Y-o-Y		CAGR 2001-13	in GDP		in employment		in total exports		(per cent) Y-o-Y		CAGR 2001-13
			2001	2013		2001	2013	2001	2013	2001	2013	2001	2013	
US	1	1	2.1	1.7	1.8	77.6	78.6	75.0	81.2	27.2	29.5	-3.6	5.0	7.7
China	2	2	10.3	8.3	10.7	40.5	46.1	27.7	35.7	11.0	8.5	9.1	7.5	16.5
Japan	3	3	1.3	0.8	0.7	69.0	72.4	63.9	69.7	13.6	16.9	-6.9	2.0	7.1
Germany	4	4	3.1	0.1	0.9	68.8	68.4	64.6	70.2	12.8	16.5	5.6	7.8	10.7
France	5	5	2.0	0.6	1.4	74.7	78.5	69.9	74.9	19.8	29.0	-0.5	9.7	9.5
UK	6	6	3.4	2.0	2.2	73.6	79.2	73.8	78.9	30.1	35.1	-0.8	1.5	7.9
Brazil	7	8	1.8	2.1	3.5	67.1	69.4	59.4	62.7	13.0	13.4	-2.7	-1.7	12.9
Italy	8	7	2.3	-1.3	0.2	70.5	74.4	63.1	68.5	18.9	17.6	2.1	6.1	5.6
Russia	9	10	3.3	2.0	5.1	55.6	59.8	58.6	62.3	9.9	11.0	17.3	11.2	4.0
India	10	11	7.5	6.7	8.7	51.3	57.0	24.0	28.1	27.9	32.5	4.8	3.6	20.1
Canada	11	9	3.5	1.8	2.5	65.9	70.4	74.7	76.5	12.7	14.6	-3.6	0.0	6.2
Australia	12	12	3.7	2.5	3.0	69.9	69.7	74.2	75.5	21.8	17.1	-8.9	-0.1	9.4
Spain	13	13	4.0	-1.1	2.3	65.3	73.9	62.0	74.9	32.2	31.5	6.0	6.1	8.4
South Korea	14	15	5.0	2.9	3.7	59.0	59.1	62.6	76.4	16.3	16.6	-4.9	1.3	15.7
Mexico	15	14	1.1	2.4	3.2	57.7	58.9	56.1	61.9	7.2	4.9	-7.5	21.3	11.8
World			**2.5**	**2.1**	**2.5**	**68.8**	**66.0**	**39.1**	**45.1**	**19.4**	**19.8**	**0.1**	**5.6**	**9.9**

Source : Computed from UN National Accounts Statistics for GDP, World Bank and ILO database for employment and WTO database for Services Trade.

Notes : Rank and share are based on current prices (2013); growth rates are based on constant prices (US$); construction sector is excluded in services GDP; for employment data in 2013, the available data of nearest preceding years is used.

The service sector in India is extensively diverse, providing services to a wide gamut of skills and technology levels from activities such as trade, retail, and entertainment to sectors like Healthcare, IT/ITES, and financial services. The services sector scenario in India is complex and is characterized by an uneven development in different types of services. The growth in output in this particular sector in the recent times has mostly come from the rapid development of skill intensive services in the IT/ITES. The construction sector, hotels and transport have also improved their growth rates over the preceding years, though to a lesser extent. However, the growth rate of social and personal services has declined significantly. Insurance & real estate have retained their growth momentum (Das & Raut, 2014). Several sectors like IT/ITES, healthcare, telecommunications, banking & financial services have been benefited because of the economic liberalisation and were able to attract foreign capital and technology. Literature shows that services such as IT, telecommunications and financing services have contributed to the high growth of the services sector (Chahal, 2015).

On one hand with the advent of liberalization and globalization, Indian service industry is facing competition from multinational companies. On the other hand advances in technology and globalization have heightened customer expectations. The other major challenge is to retain and expand the competitive advantage in those services where India has already made a mark. New competitors from other developing countries are making rapid strides, even in the areas where India had an initial advantage as in the case of software services. Although India is portrayed as a major exporter of services, its rank among WTO member countries in services exports is lower than that of China's and its export competitiveness concentrate in few sectors and a few markets (Mukherjee & Goyal, 2012).

Necessity is the mother of innovation (invention). Faced with global competition, reducing geographical barriers and demanding native customers Indian service companies are increasingly becoming aware of the need to achieve operational and service excellence to be globally competitive and to meet the customer's changing needs. Trying to perform in line with these changing needs, they are adopting various methodologies like Quality Circles, Total Quality Management (TQM) and ISO Certification for achieving overall operational and service excellence. However, these methods have failed to deliver required performance in Indian industries over the last decade or so (Antony & Desai, 2009). Thus to compete, the Indian service industry need to be at par with their global competitors and need to adopt lean. In developing economy like India lean initiatives are important as they enable the organisations with limited resources to undertake not only process improvements but also lead to education , empowerment of employees and improvement in working environment.

1.4 Lean Services

Organisations in the service sector are constantly under pressure to deliver excellent customer service, faster response times and valuable support for their customers. Lean Management helps to look at service organisation holistically as a system, targeting at wastes helping to deliver in line with customer expectations and need, leading to cost efficiency and greater profitability. The service organisations require the ability to achieve consistent service excellence backed by efficient processes that are continuously improved (Sarkar, 2007). Lean management isn't about manufacturing. It is about standardizing work processes to make problems visible and developing problem solving ability in employees so that they can solve those problems and improve work processes.

Lean management in services and its impact on performance has not received the similar deliberation as in manufacturing. However, most of the practitioners and academicians believe in universal applicability of lean thinking as it aims for process improvement by eliminating Non Value Added (NVA) activities and do not focus only on output of processes. The rising importance of service industries in world economy along with the comprehensive benefits achieved from lean management in manufacturing has led several researchers to study the applicability of lean system to services (Piercy and Rich, 2009). Bowen & Youngdahl(1998) pioneered use of lean in services by advocating transfer of production-line approaches from manufacturing to service using examples from different service sectors. Majority of the literature focuses on conceptual and case based studies of adoption of lean in services (Suárez-Barraza et al., 2012; Gupta et al., 2016). These studies indicate the significant impact of lean implementation on delivery, speed, cost, quality and satisfaction of both customers and service providers.

However, production of services is also a process hence one may study service production and delivery as a process and eliminate waste or non value added activities within these processes. Authors (George, 2003; Ahlstrom, 2004; Liker & Morgan, 2006; Sarkar, 2007; Radnor, 2010; Staats et al., 2011; Malmbrandt & Ahlstrom, 2013; Hadid et al., 2016) have agreed to the viability of implementation of lean in services resulting into improved processes, reduction in NVA activities and increase in customer satisfaction . Swank (2003) made a case of using lean in services citing many tools of lean have been developed from service industry. Abdi et al. (2006) sees lean thinking experience in combination of service marketing as a powerful toolbox for services manager. Ahlstrom(2004) believes that the principle of decentralised responsibilities of lean has more applicability in services than in manufacturing as in services decisions often have to be taken on the spot by the employees meeting the customer thus they need to have the authority to take these decisions. Piercy & Rich(2009) assured the usefulness of lean practices in streamlining services and designated the value stream mapping as the most important tool giving services a system or holistic view which was missing in them. Various authors (May, 2005; Abdi et al., 2006; Liker & Morgan, 2006; Sarkar, 2007) have emphasized on human centric approach to Lean implementation in services. Knowledge workers in services need strategic thinking and deeper problem solving capabilities which in turn requires collaboration, empowerment, innovation, and cross functional relationship. As services are delivered for people by people hence human variable comes out to be an important variable in service sector. Along with this commitment is needed from the management as Lean practice is not just a tool rather a strategic move towards the cultural transformation. Brown et al., (2015) solicits adherence to lean principles as strategic imperative to sustain sufficient organizational flexibility against structural changes in financial and customer markets.

Service companies experienced challenges in implementing lean because of over reliance on lean tools without focusing on philosophy behind lean (Osborne et al., 2013) resulting into lean cosmetic change . Some of the most difficult aspects of adapting the lean approach to service operations are overcoming the perception that manufacturing concepts do not apply to service operations, establishing a metric-driven environment, and building a culture that embraces rather than resists change (Allway & Corbett, 2002). Brandao de Souza (2009) and Mazzocato et al. (2010) in their literature review agreed that holistic view emphasised by lean is missing in services as most cases reported as lean because they use one or two lean principles, requiring a long term view of continual improvement. Lack of awareness about advantages of implementing lean, ineptitude to recognize waste through the analysis of the customer experience and inability to understand inefficiencies that intrude with services poses a major challenge in implementing lean in services. Atkinson (2010) emphasised on planning for lean implementation as lean leads to changes not only in technical process but also in emotional, behaviour and political process. Thus implementation of lean management is an exercise in change management and the philosophy of lean management needs to be embedded in the culture of the organization so that improvement can be continuous (Puvanasvaran, 2011; Asnan et al., 2015).

The lean transfer to services cannot be straight from manufacturing as the inherent characteristics of services lead to certain contingences when adopting lean in services (Ahlstrom, 2004). Standardizing services and increasing reliability in service processes through lean principles can increase efficiency but the customer's role as a value creation partner in certain services, simultaneous production and consumption, high diversity make the application of lean principles increasingly difficult (Carlborg et al., 2013) and necessitates for adapting lean approach for services. Though the principles of lean management cannot be directly implemented to services, the principles of lean like respect for humanity, voice of customer , value stream , elimination of waste, standardizing processes, let the value flow at pull of customer etc. are still valid.

Very little research has been carried out relating to the status of lean implementation in the Indian service industry. Indian service industry has been learning from an array of lean concepts and over the last five years there have been substantial attempts in adopting lean practices. The adoption in certain sectors like IT/ITES and financial services has been significant as they have been exposed to global competition and catering to clients all over the world. Staats et al., (2011) through their exploratory work in Wipro proved that lean implementation in knowledge work is possible and that it changes how the organization learns through hypothesis-driven problem solving, streamlined communications, simplified process architectures and, to a lesser degree, specified tasks resulting in improved operational performance. Díaz et al., (2012) have examined the operations of Aravind Eye Hospital, the largest eye care provider in India. Govindarajan & Ramamurti (2013) have studied nine hospitals in India to study how these hospitals are providing world-class health care at ultralow cost. As authors say these organisations were not explicitly influenced by lean practices but they are implicitly present in the processes. Thus there is lack of understanding of the lean concepts and culture in Indian service industry. The rate of change has been slow mainly due to management's apprehension of the impact of lean adoption on work culture and on limited resources, anxiety regarding change, lack of awareness and training about the lean practices and time & cost associated with it. A systematic methodology does not exist for the adoption of lean in Indian services.

Majority of research reported in literature review are based on case studies from developed economies. Even less research has been carried out in the area of Lean implementation in Indian service industry. Majority of reported work are organization specific not industry specific. Thus exhaustive industry specific study is required, especially in developing country like India. Many Indian service industries are adopting different lean management practices but in silo manner. These piece meal approaches in lean practices can be effective in the short run but in the long run these might cause a problem of fit. Lean is needed to be adopted as a way of thinking with long term vision and not just a tool box. Suárez-Barraza et al., (2012) in their literature review of lean services emphasized that today's service organisations need a series of guiding principles and/or road maps that derive from an integrated and holistic vision, rather than rely on random ready-made recipes or check lists. Moving towards a Lean service organization is a large scale and long term venture. One central feature of such a venture is to have a model/framework guiding and directing the lean implementation. Though other quality practices like Six Sigma have universally accepted frameworks for structured deployment, there is no such structured framework for lean management in services. The frameworks which have been reviewed are typically used in other countries and are organisation or industry specific and can't be considered as an effective guideline for any service business approaching a Lean transformation. Frameworks have significant differences and some frameworks do not address all the issues. Therefore the proposed research will focus on addressing these issues and develop a comprehensive framework for lean implementation in services. The study will further do an empirical investigation of lean management in Indian service industry. The empirical testing of the framework in service industry will also provide an understanding of the effect of lean practices on performance of organisation. The research aims to study not only Lean management impact on operational performance but also its capability to improve business performance, an aspect where current literature is falling short.

Empirically examining lean management in the service industry will provide testimony whether lean management which originated in the manufacturing context can be effective in different contexts too. The knowledge till date about the lean services are mainly from case studies and conceptual literature (Suárez-Barraza et al., 2012), which due to their inherent limitations are unable to provide generalised results on the effectiveness of lean services (Hadid & Afshin Mansouri, 2014). This in itself calls for empirical studies so that more evidence can be garnered towards applicability of lean management in services. If it can be determined that Lean enhances performance in services, more organisations would go for implementing the same which could help in growth of not only the sector but economy as a whole. If on other hand it can be concluded that Lean management in services is not as effective as in manufacturing, organisations will again benefit by considering other methodologies for improving performances. Thus, the present research aims to add towards the demand of empirical study (survey based) on lean services.

1.5 Objectives of the research

The objective of the proposed research is to empirically investigate the lean management in Indian service industry. The objectives of the research study are:

- To develop comprehensive bibliography of lean management in services.
- To assess the reliability and validity of existing frameworks in selected Indian Service Sectors.

- To develop a framework for lean management in services.
- To assess the reliability and validity of proposed framework in selected Indian Service Sectors.

1.6 Research Methodology

To achieve the objectives of this study systematic search of Lean literature was done in multiple databases using key terms “Lean Service”, “Lean Implementation in Service”, “Lean Management in services” and “Lean framework in services”. The literature helped to identify that gaps and formulate the research problem. The identified lean service frameworks were validated in Indian service industry through a cross sectional survey. The need for the comprehensive framework was established. Identification and selection of lean pillars and initiatives, operational performance measures and business performance measures were done using extensive literature review and comparative analysis. An empirical research using cross-sectional survey of lean practitioners and lean experts working in the field of Banking/Financial Service, Healthcare, IT/ITES and Telecom was conducted across India in order to validate the proposed Lean Service Framework. The empirical analysis was conducted using Factor Analysis and Regression Analysis. The statistical validation was followed by case studies conducted in two service organisations which were at two different stages of lean implementation.

1.7 Organisation of the Thesis

The thesis is organised into eight chapters. The Chapter two discusses the literature review. This chapter presents the review of most widely published Lean service journal articles to gain insight into the concept of lean/ lean services. The aim of literature review is to identify research gaps and development of research framework to fill these gaps. The research methodology adopted is illustrated in chapter three. Chapter four discusses the reliability and validity of existing frameworks in selected Indian service sectors. Chapter five presents the development of the proposed framework for lean implementation in services. Chapter six illustrates an empirical investigation of lean management in selected Indian service sectors. It presents the data collection from selected service sectors and analysis of the same. Chapter seven demonstrates the applicability of proposed framework in Indian service industry through two case studies. Lastly, chapter eight gives some recommendations for effective lean implementation depending on the stage of lean application. This chapter also summarises the findings and the conclusions of the research work with limitations and scope for future work.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Lean is a process improvement methodology focusing on reducing ‘Muda’ or waste in any process to enhance performance, increase productivity, enhance quality, shorten lead times and reduces costs (Peng et al., 2008). Though originated for manufacturing, initially known as Toyota Production System (TPS), Lean Management is increasingly being used in services too since commencement of 21st century. This philosophy was not invented at a single point, but is an outcome of a dynamic learning process that adapted practices from the automotive and textile sectors in response to environmental challenges in Japan after the Second World War (Fujimoto, 1999; Holweg, 2007).

The chapter[1] highlights the importance of Lean methodology and identifying Lean’s implications & applications in the service industry right from its commencement in 1990s until today. The chapter has tried to answer the following questions through literature review:

(1) How have Lean services evolved over time?
(2) Service sectors/areas in which lean has been implemented?
(3) Which Lean tools are used in services?
(4) What are the benefits achieved through lean implementation?
(5) What are the gaps in the literature/research done so far?

2.1.1 Definition of Lean

Lean has been defined by many researchers, academicians and practitioners. A few viewed it as methodology of identifying value and reducing waste whereas others have defined it as a way of focusing on customer. Schonberger (1986) believes Lean is about focusing on seven

[1] The part of this chapter has been published in International Journal of Productivity and Performance Management, 2016, Vol. 65, No8. 1025-1056

wastes and on respecting people i.e. customers, employees, suppliers etc. Comm L. & Mathaisel (2005) saw lean methodology as "Lean" because it is a way of doing more with less. Abdi et al.,(2006) viewed it as an improved utilisation of the organisation's resources. Shah & Ward (2007) visualizes lean as the set of tools designed to increase business competitiveness by systematically eliminating all types of waste. For Holweg (2007) lean is an integrated set of socio-technical practices aimed at eliminating wastes along the whole value chain within and across companies. Alves et al., (2012) visualized lean production as a model where workers assume the role of thinkers and their involvement promotes continuous improvement). As per Wahab et al., (2013) the core idea of lean manufacturing is to maximize customer value while minimizing waste. Lean management is about improving quality to eliminate non-value adding activity (i.e. waste) (Burgess & Radnor, 2013). Toussaint & Berry (2013) saw lean management as a cultural transformation that changes how an organisation works.

It is difficult to find one definition of "Lean" with universal agreement. The uncertainty is mainly because of its evolution over a period of time (1950's onwards to still evolving) and also because of its mistaken equivalence with other quality-related approaches (Womack et al., 1990; Spear & Bowen, 1999; Hopp & Spearman, 2004). The lack of distinction between the system and its components further adds to the ambiguity in defining Lean; and hence many perceive Lean as just a tool box and, in doing so, miss the sensible philosophy behind it. A few illustrative definitions of Lean as defined by various authors are given in table 2-1.

Summarizing the definitions, Lean can be stated as "an integrated multi-dimensional approach encompassing wide variety of management practices based on philosophy of eliminating waste through continuous improvement." The same will be used as definition of Lean management in this study. Thus, Lean is not just a tool but is a culture, a practical philosophy for quality improvement. Toyota's success with Lean lies in the company's ability to understand and motivate its workforce (Liker, 2004). Thus, Lean as a philosophy becomes a way of thinking, whereas practices or tools are instruments to action these thoughts (Karlsson & Ahlstorm, 1996; Liker, 2004; Sa´nchez & Pe´rez, 2004; Bhasin & Burcher, 2006).

Table 2-1: Definitions of Lean in Literature

Authors	Definition
Womack, Jones, & Roos (1990)	Lean is an approach which uses half the hours of human effort in the factory, halves the defects in the finished product, requires one-third the hours of engineering effort, half the factory space for the same output, a tenth or less of in-process inventories
Liker (1996)	Lean is a philosophy that when implemented reduces the time from customer order to delivery by eliminating waste in the production flow.
Womack & Jones (1996)	Lean Management a philosophy that follows five principles (value, value stream, flow, pull and perfection) to eliminate all sources of waste(or muda) from the production processes
NIST (2000)	A systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection
Allway & Corbett (2002)	Lean is an approach of eliminating non-value activities from work processes by applying a robust set of performance change tools and emphasizing excellence in operations to deliver superior customer service.
George (2003)	Lean is to accelerate the velocity of any process by reducing waste in all its forms
Hopp & Spearman (2004)	Lean production is an integrated system that accomplishes production of goods/services with minimal buffering costs
Holweg (2007)	Lean manufacturing extends the scope of the Toyota production philosophy by providing an enterprise-wide term that draws together the five elements – product development process, supplier management process, customer management process, and policy focussing process.
Shah & Ward (2007)	An integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimising supplier, customer, and internal variability.
Hallgren & Olhager (2009)	Lean is a programme aimed at increasing the efficiency of operations throughout an organization.
Radnor (2010)	A management practice based on the philosophy of continuously improving processes by either increasing customer value or reducing non-value adding activities (Muda), process variation (Mura), and poor work conditions (Muri).
Langstrand (2012)	Lean is defined as a strategic perspective, a tactical toolbox, a philosophy, and a method.
Karim & Arif-Uz-Zaman (2013)	Lean are the activities performed to minimise the waste and non value added operations while improving the value added process
Sisson & Elshennawy (2015)	Lean is a business philosophy focused on shortening lead times by removing waste and concentrating on value-added processes.
Hussain et al.,(2016)	Lean production is the concept of systematic elimination of “waste” or Non-value-adding activities that are not desired or are not necessary to fulfil a customer request.

2.2 Lean Services

Today the service sector is a vital part of economy globally, contributing to more than 50 percent of the gross domestic product of top economies (GOI, 2013). Kotler(2003, p. 444) defines service as "any act or performance that one party can offer to another that is essentially intangible and does not result in ownership of anything". Its production may or may not be tied to a physical product. Grönroos(1990, p. 27) sees it as an "An activity or series of activities of more or less intangible nature that normally, but not necessarily, take place in interactions between the customer and service employees and/or systems of the service provider, which are provided as solutions to customer problems". The special characteristics manifested by services such as – intangibility, heterogeneity, inseparability, simultaneity and perishability (Lovelock & Gummesson, 2004) make it distinct in its own way when compared to manufacturing. Osborne et al., (2013) when applying their service dominant theory agreed that the core features of services are: its intangibility – it is a process, in services production and consumption occurs simultaneously and lastly the user is the co-producer in the services. There are certain principles of lean management which need to be adapted as per the unique characteristics of services. Due to the presence of customer in the service process, and he being the co-producer identification of waste is sometimes tricky, since the expectations of customers may differ. What is waste for one customer may be valuable for another. Secondly is the principle of zero defects. Although a low defect rate is the key in many service processes, the presence of customers in the process makes it unrealistic to achieve zero defects. Thus, effective service management requires both governing and responding to the service expectations of service users; training and motivating the service delivery workforce to interact positively with these users along with the design of services that require simultaneous production and consumption with the presence of user as a co-producer. The failure of services management is mainly due to attempting to provide a "missing product" rather than concentrating upon the process of service delivery (Grönroos, 1998). According to Ahlstrom (2004), prioritization and recovery from failure are more important in the service sector.

All around the globe numerous manufacturing companies have embraced the Lean culture and now the Lean movement is spreading to service industries (Hanna, 2007; Staats et al., 2011; Hasle et al., 2012; Abdelhadi, 2016). The early attempts were made in 1990's by service organisations to adopt Lean methods. However, the practitioners encountered a few challenges in this endeavour. The primary challenges in applying Lean in the service industry is the lack of awareness about the benefits of implementing Lean and the fear that the identification of waste and inefficiency can meddle with services – fears that are rarely substantiated.

Several articles reviewing Lean manufacturing are available in literature but very few are available reviewing Lean services. Suárez-Barraza et al. (2012) have categorised literature on Lean services into categories as exploration, theoretical framework, case studies, and new trends; and suggested gaps for research in future. A review by Leite & Vieira (2015) stated that despite the lack of standards and a methodology for use in services, Lean when applied to services can generate large economic and financial results, as well as improvement in workers' behaviour. Brandao de Souza (2009) states improvement strategies central to Lean like staff empowerment, the concept of gradual and continuous improvement has made Lean more adaptable to healthcare leading to sustainable results . Mazzocato, et al. (2010) used the concept of intervention (I) in a context (C) triggers a mechanism (M) which generates outcomes (O), to study Lean application as an intervention in different healthcare settings using Lean tools and methods as mechanism that resulted in positive outcomes. Many authors have agreed that the holistic view emphasised by Lean is missing in many reported cases because the implementers use only one or two Lean principles. Similarly, Pernstål et al. (2013) in their study of software development influenced by Lean approaches concluded that the majority of papers have focussed on eliminating waste and creating flow in the software development process. Research papers offering specific advice to industry professionals pursuing improvements in large-scale software development, by applying Lean principles and practices, are scarce.

In this study, a systematic literature review of the lean in services was done to identify the research gaps. A total of 460 articles on lean services were downloaded using multiple databases including Google Scholar, Emerald, and Science Direct using keywords/key terms "Lean Service", "Lean Implementation in Service" and "Lean Management in services". The majority of articles were drawn from peer-reviewed international journals; however due to the dearth of articles broader academic sources like conference publications and research thesis were also considered. Books and publications in hard copy were also included to gain more understanding into Lean services.

An article list was made and duplicate records were removed. The list was further shortened by checking titles for relevance of review. The abstracts of all the included articles were read and, unless thought unrelated, the full paper was read to filter the articles. Finally, only those articles were included which were directly relevant to our research aim. A total of 147 references were read thoroughly for Lean services. 45 additional articles were read from the field of Lean manufacturing and service management to ensure a clear understanding of "Lean" and to gain more insights on services.

2.3 Descriptive analysis

Descriptive analysis of the reviewed sources divulged some interesting inferences. The literature sources were analysed against three attributes, namely: time, publisher and the region, thus catering to the aim of studying the evolution and application of Lean in services. Using a chronological angle, the manner in Lean in services had evolved over time was observed. Figure 2-1 shows the number of articles published annually during the period under analysis. As Bowen & Youngdahl's (1998) is the pioneer article hence it is taken as the starting point. A search revealed articles from diverse journals in the fields of operations, healthcare, quality, software, management, etc. Figure 2-2 shows the coverage/spread of articles in the journals of various publishers (Choong, 2013; Bhamu & Sangwan, 2014; Vamsi Krishna Jasti & Kodali, 2014). The available literature was classified on a regional basis (Figure 2-3) to show how Lean services have been adopted globally (Bhamu & Sangwan, 2014). These three aspects are dealt in details in the following sections.

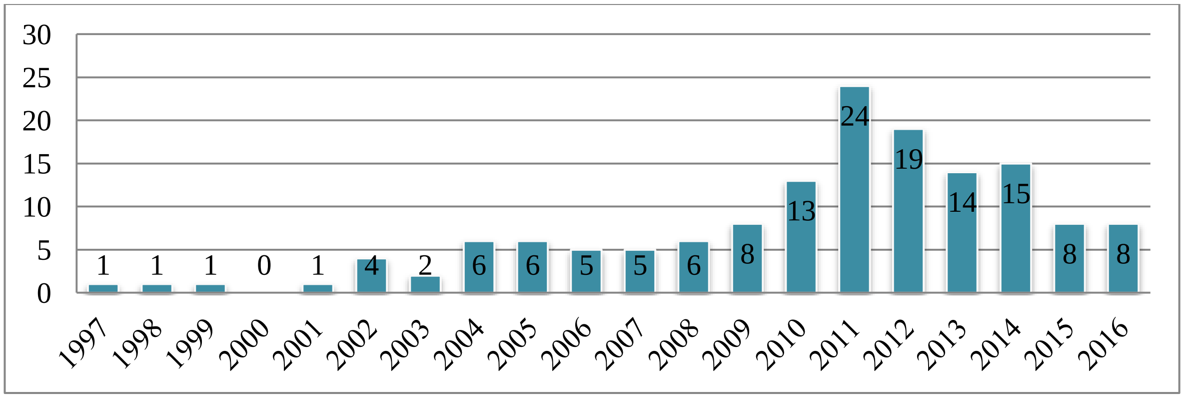


Figure 2-1: Papers Published on Lean in Services by year (1998-2016)

It is apparent in the reviewed literature that not until 2004 does an uninterrupted flow of publications appear (Figure 2-1). Therefore, the analysis in this study is focussed on the period 2004-2016, although earlier papers have been also reviewed to gain knowledge about researchers' views in that earlier era. The bulk of the articles are from 2010 to 2016, thus indicating a latest interest in this area of research. One can conclude that Lean, which gained recognition outside Japan in 1980's and gained momentum in manufacturing in 1990s after the publication of the book The Machine That Changed the World (Hines et al., 2004), gained inroads in services almost a decade after it took off in manufacturing in 1990s. Thus its way behind manufacturing in implementing lean management and will take more time to come at par with manufacturing.

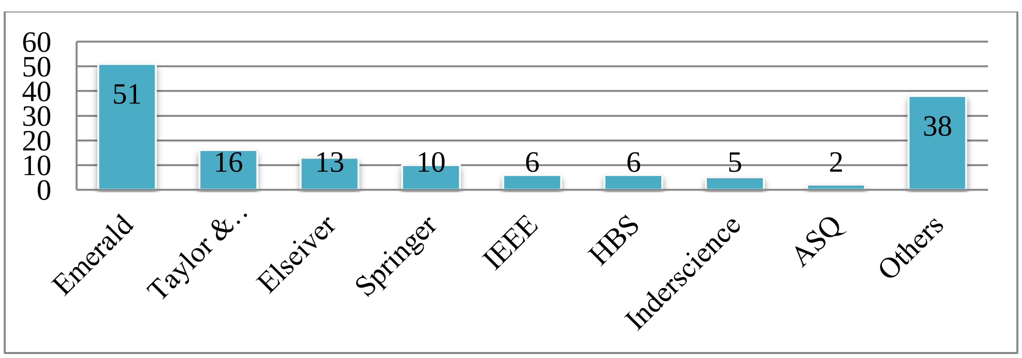


Figure 2-2: Peer-reviewed papers published on Lean in services by different publishers

At the publisher level, 51 articles have appeared from Emerald, followed by 16 Taylor and Francis, 13 from Elsevier, ten from Springer, six from IEEE and Harvard Business School-related publications and five from Inderscience publications. The rest are from other peer-reviewed journals and from different sources like proceedings of conference, MS thesis, etc.

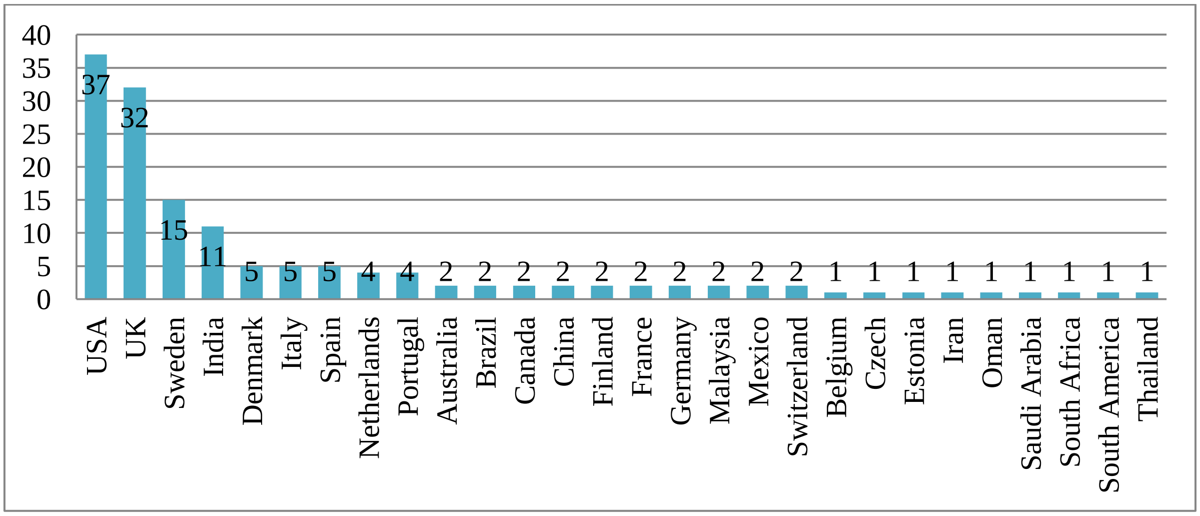


Figure 2-3: Number of research papers published by country of researchers

The distribution shows Lean has been applied across the globe. Though, only 18 per cent of the articles are from developing economies whereas the rest, 82 per cent, are from developed economies. 47 per cent of articles published are from USA and UK. Developing economies are way behind developed economy in the adoption of Lean. Questions can be raised such as: are they still only cost centric, are they still not customer-focussed despite the larger consumer base? The answers to such questions have to be researched.

Further to this high-level descriptive analysis, the researcher has identified patterns in the literature based on two dimensions which is further detailed in the next section.

2.4 Taxonomy of Lean service literature

The Lean service literature has been viewed on two dimensions, namely time and content. From the perspective of content, Lean services are categorised into Conceptual/Theoretical Publications, Lean Service Frameworks/Models and Lean Service Applications/Case Studies (Figure 2-4).

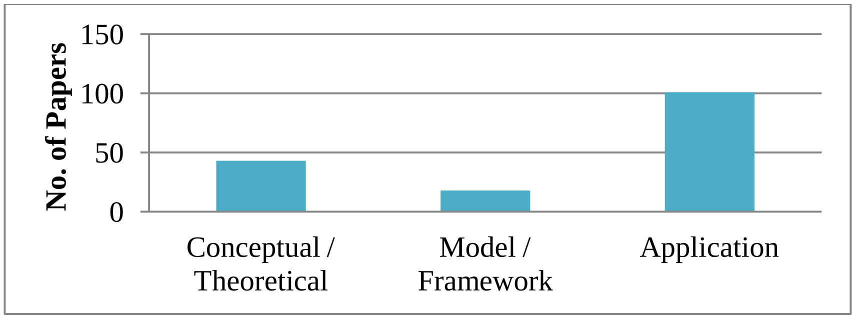


Figure 2-4: Taxonomy for Lean service literature

Figure 2-5 below lists the major ideas of each era along with trailing the history of service management and identifying the major ideas which altered or helped in the growth of Lean services. Table 2-2 lists some of the most cited articles of each era. Table 2-3 shows the literature categorised by content and time dimensions, i.e. evolution of Lean Services. These are discussed in more depth in the following sections. From the Time perspective, authors have studied the evolution of research on Lean in services; and have classified it into four eras similar to the stages of adoption of any new methodology. These are pre era, era of awareness, era of exploration and finally era of adoption or implementation of Lean. On the basis of findings and background of papers of each year the time interval was arrived at.

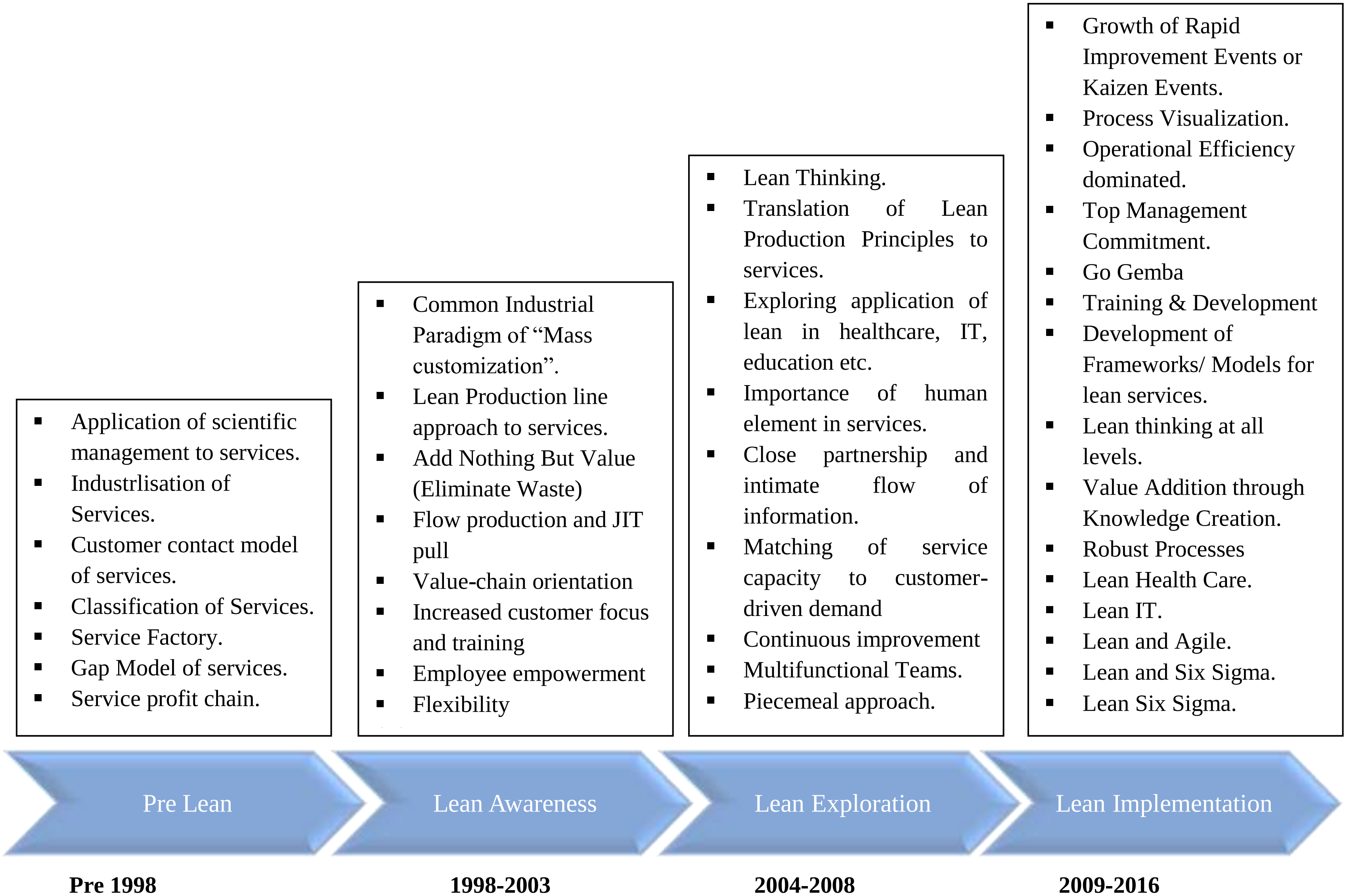


Figure 2-5: Evolution of Lean Services

Table 2-2: Evolution of Lean Services

Year	**Pre 1998**	**1998-2003**	**2004-2008**	**2009-2016**
Phase	Pre Lean	Lean Awareness	Lean Exploration	Lean Implementation
No. of "Lean Publications"	--	9	27	111
Literature Examples	Skinner(1969), Levitt(1972), Parasuraman, et al.(1985), Chase & Garvin(1989), Heskett et al.(1997)	Bowen & Youngdahl (1998), Middleton (2001), Poppendieck (2002), Swank(2003)	Ahlstrom (2004), Apte & Goh (2004),May (2005), Abdi et al.(2006), Liker & Morgan (2006), Fillingham (2007), Hanna (2007), Radnor & Boaden(2008)	Souza (2009), Grove, et al. (2010b) , Radnor (2010), Dahlgaard, et al. (2011), Staats, et al. (2011), Al-Hakim & Gong (2012) , Díaz, et al. (2012) , Johnson, et al. (2012), Burgess & Radnor (2013) , Carlborg, et al. (2013) Malmbrandt & Ahlstrom (2013), Timmons et al., (2014), Sanders & Karr(2015) Blackmore & Kaplan(2016) ,

Table 2-3: Categorisation of Literature as per Evolution of Lean Services

Category	**Theoretical**	**Framework / Model**	**Applications**					
Year			**Healthcare**	**IT/ITES**	**Financial**	**Education**	**Public Sector**	**Others**
1998-2003	2	2	1	2	1	1	0	1
2003-2008	8	6	6	2	4	3	2	3
2009- 2016	35	10	32	17	6	4	8	10

2.4.1 Categorisation of literature based on "time"

2.4.1.1 Pre-Lean era (before 1998)

Skinner (1969) in 1969 came up with the idea that the manufacturing sector can act as an exemplar for the organisations in the tertiary sector in terms of composing solutions for improving their productivity and efficiency. Then, from the 1970s, a discussion began as to whether goods and services could be treated as the same. Table 2-4 depicts major ideas in pre-Lean era of service management.

Shostack (1984) gave concept of service blueprint which helped in understanding service process, identifying problems and also to detect new market opportunity and to test quality of services being offered. The model of industrialisation of services began to lose ground in late 1980's and some publications in the arena of services began to move towards a new logic which was called as "Service Quality". This led to opening of new field in services like 'Service Marketing' or 'Service Operations' or 'Quality of Service' and development of models like SERVQUAL (Parasuraman, et al. ,1985). Chase & Garvin (1989) described in their article 'Service factory' the forces that pushed manufacturing firms to rescue service and have given rise to terms like quality, consideration to the customer and inter-functional teams.

Table 2-4: Pre-Lean era of service management (Pre 1998)

Year	Author	Major Idea
1984	Shostack (1984)	Service Blueprint
1985	Parasuraman, et al. (1985)	SERVQUAL
1989	Chase & Garvin (1989)	Service Factory
1990	Hart, et al. (1990)	Failure Demand and Service Recovery
1997	Heskett, et al. (1997)	Service Profit Chain
1998	Vandermerewe & Rada (1998)	Servitization

Hart, et al. (1990) talked about failure demand and proposed that a good recovery from service failures can turn dissatisfied customers into loyal ones. Heskett, et al. (1997) in their article "Service profit chain" relates profitability and revenue growth of a service organisation with the satisfaction and loyalty of its employees. Loyal and productive employees will generate satisfied customer, hence service organization should pay attention to human resource issues as providing accurate and timely information, selection and training of staff, and designing motivating reward and recognition systems for the employees. Vandermerewe & Rada (1998) coined the term servitisation defining it as the increased offering of fuller market packages or 'bundles' of customer focussed combinations of goods, services, support, self-service and knowledge in order to add value to core product offerings".

In the pre lean era the industrialisation of services started emphasising on quality, understanding service process, balancing demand and supply of services, gap model of service quality, failure demand, and customer satisfaction along with employee loyalty. These ideas form the foundation on which services are designed and managed today.

2.4.1.2 Lean awareness era (1998-2003)

Bowen & Youngdahl (1998) published the first article advocating use of lean production-line approach to services emphasizing that traditional mass production line approach is no longer applicable either to manufacturing or services. Referring the examples of Taco Bell, SW airlines and Shouldice hospital, authors proposed that the service-driven model followed by these organisations mirrors the characteristics of Lean. Allway & Corbett (2002) identified a rigorous five-phase process, successfully followed by an insurance company to generate positive results and showed the successful adoption of manufacturing techniques in services. Middleton (2001) and Poppendieck (2002) agreed on the applicability of Lean in the software development process, although they emphasised the deep changes needed in the way an organisation is managed for the implementation of Lean. Nightingale (2002) advocated on system perspective of lean as Lean Enterprise defining it as an integrated entity that efficiently creates value for its multiple stakeholders by employing lean principles. She stated lean being used as an important strategy in achieving critical strategic goals such as responsiveness, cycle time and cost. Comm & Mathaisel (2003) advocated use of lean in education stating the need of quality improvement and the sustainability of colleges and universities in providing affordable higher education. . Swank (2003) made a case for using Lean in services, citing many tools of Lean that have been originally developed by the service industry and are adopted by manufacturing. Like JIT was developed from the concept of "Supermarket"; thus service organizations by adopting lean are bringing the principles of lean management back home.

From the review of this era it can be ascertained that services in this era were battling to improve quality and to satisfy customers along with tackling the external challenges of globalisation and coping with the advent of IT. Many were looking at manufacturing for various improvement methodologies as an elixir for their problems. Various authors such as Bowen and Youngdahl (1998), Middleton (2001), Poppendieck (2002), Comm and Mathaisel (2003) and Swank (2003) agreed on the universality and applicability of the principles of Lean thinking across many disciplines. But they felt that Lean could not be adopted in services just as it is from manufacturing. The management of virtual factories or services is harder as customer interaction, resistance to try new things, acceptance toward changes, and higher employee turnover make it crucial to comprehend how the Lean methodology must be adapted to service environments (Allway and Corbett, 2002). Simultaneous production and consumption of services, along with the presence of the customer as co-producer; calls for a tailored Lean approach for services. Authors agreed though, when properly applied, Lean thinking can help services improving productivity along with cost efficiency.

2.4.1.3 Lean exploration era (2004-2008)

This era was marked with exploring the pertinence of lean in services by truly implementing lean across service industry in different areas of Health care, IT, Financial Services, Education etc. Authors like Ahlstrom (2004), May (2005), Fillingham (2007) and Hanna (2007), agreed that Lean principles can be translated to services but this translation cannot be mindless or literal. There are contingencies to Lean adaption due to involvement of customer and the inherent nature of services such as intangibility, heterogeneity, inseparability, simultaneity and perishability. Spear (2005) and Kollberg, et al. (2007) studied adaptation of Lean in health care and concluded that commitment to process improvement has improved quality and reduced costs. Kim et al., (2006) too believed that hospitals are ready to take action in delivering care of greater quality with more efficiency by applying lean principles in the hospital setting. Apte & Goh (2004) found that minor modifications in Lean manufacturing leads to similar benefits as cost efficiency and customer satisfaction in information-intensive industries. De Koning et al., (2008) regarded the application of a wide spectrum of principles of Lean offer useful solutions that can provide a better economy, greater efficiency and better quality in the financial services industry. Emiliani (2004) and Comm L. & Mathaisel (2005) studied how higher education is performing on cost reduction or budget containment initiatives.

May (2005), Abdi, et al. (2006), Liker & Morgan (2006) and Sarkar (2007)have emphasised the human-centric practices of top management commitment, employee training, group solving etc. in implementing Lean in services. Knowledge workers need strategic thinking and deeper problem-solving capabilities which in turn requires collaboration, empowerment, innovation and cross-functional relationships. Emphasising the power of customers and for the acceptable use of Lean in services, Womack & Jones (2005) suggested six principles as: a) completely solve the customers' problems by ensuring that all services operate and, especially, work together; b) do not waste the customers' time; c) provide exactly what they want; d) exactly where it's wanted e) exactly when it's wanted and e) Continually aggregate solutions to reduce the customer's time and hassle. Hineset al. (2004) believed that lean has evolved and continues to do so. During the evolution it has adhered to the basic principles as described by (Womack & Jones, 1996) but has explored different applications and contingencies faced by organisations during the adaptation process. Not only is it necessary to implement most of the technical tools but an organisation's culture needs transforming too (Bhasin & Burcher, 2006).

Most of the researches in this era (2004-2008) remained conceptual and descriptive, and the amount of empirical research in Lean services was still minimal. Largely the researches observed in this era were piece-meal approaches that almost never created a true learning culture. Attempting to go Lean by just applying a Lean as a mere tool box of techniques in a silo fashion does not work for long-term gain. It becomes very important for a Lean practitioner to focus on the complete business value chain, rather than having a narrow "project-only" focus. According to Vijaya Sunder (2013), Lean project managers should not think narrowly about the project metric improvement alone; rather they should have end-to-end vision and understanding about the process from all perspectives. Hines et al., (2004) considered that Lean exists at two levels: strategic and operational. The customer-centred strategic thinking applies everywhere, the shop-floor tools do not. The lean tools should be applied like the shop-floor tools following Toyota's example, and lean thinking has applicability for the strategic value chain dimension. Thus a true systems approach assimilating the apt amalgamation of long term philosophy, people, processes, technology and meticulous application of Lean principles and tools must be adopted (Liker & Morgan 2006; Sapountzis & Kagioglou, 2007; Seddon et al., 2009).

2.4.1.4 Lean implementation era (2009-Present)

Empirical studies begin to surface during this phase. Many authors employed case study research method for contributing towards the knowledge base of Lean services (Radnor, 2010; Dahlgaard et al., 2011; Staats et al., 2011; Díaz et al., 2012; Burgess & Radnor, 2013; Drotz & Poksinska, 2014). Various authors like Dahlgaard et al., (2011), Kundu & Manohar (2012) and Guimarães & De Carvalho (2012) developed frameworks/models for Lean services.

Implementation of Lean in services grew (more than 75 per cent of articles reviewed are in this era) with largely work being done in field of health care and IT/ITES along with work in the sectors of education, finance and public sector. As Lean thinking gained momentum in services, top management committed leadership for its sustainment and applicability at an enterprise level was recognised as an important element (Radnor, 2010; Bonaccorsi et al., 2011; Dahlgaard et al., 2011; Kuusela & Koivuluoma, 2011; Guimarães & De Carvalho, 2012; Bortolotti et al., 2015).

Organizations applying lean concepts in a systematic manner have been highly successful from operational, market, and financial perspectives (Brown et al., 2015; Leite & Vieira, 2015). The Lean methodology can be applied in two ways: as Rapid Improvement Events (RIEs) or a fully fledged implementation approach. Most of the organisations had implemented lean as RIEs, also known as Kaizen events. Womack & Jones(1996) stated that fully fledged implementation takes anywhere from three to five years. The majority of the studies have used RIEs or the Kaizen approach (Benefield, 2009; Sua´rez-Barraza & Ramis-Pujol, 2010; Radnor, 2011; Holden & Hackbart, 2012). RIEs can be used as tools to kick off Lean in the organisation and then, once the excitement and motivation establishes, one should go for fully fledged implementation to truly adopt Lean. In line with the proposition of Hines et al., (2004) integrating other approaches (such as Agile, Six Sigma, and TQM – mainly the tools they offer) with Lean in support of a wider Lean strategy without contradicting the core objective of Lean. The amalgamation of lean with other methodologies has enriched the knowledge base of lean leading to its growth: Lean and Agile (Benefield, 2009; Petersen & Blekinge, 2010; Wang et al., 2012), Lean and Six Sigma (Antony, 2011) and Lean Six Sigma (Delgado et al., 2010; Laureani, 2012; Sunder M., 2016).

2.4.2 Categorisation of literature based on “content”

The advent of Lean in services began as we entered the twenty-first century. The publications on Lean in Services can be placed into three categories: Conceptual/ Theoretical Publications, Lean Service Frameworks/Models and Lean Service Application/Case Studies (Figure 2-6). This section analyses and describes each category and sub-category, with the addition of certain critical comments on each one.

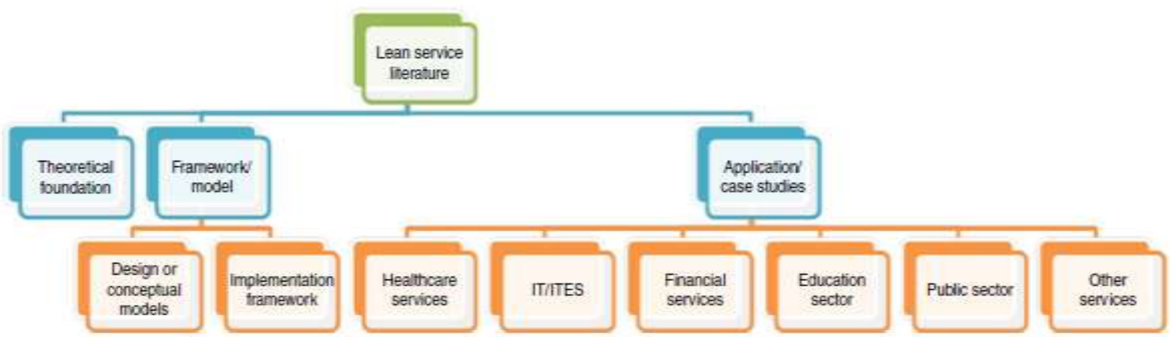


Figure 2-6: Classification based on content

2.4.2.1 Theoretical foundation of Lean service

This category deals with publications, which have strived conceptually to transfer Lean management principles, techniques and tools to the service setting. It also includes publications which have been pioneers in promoting the transfer of manufacturing principles to services. Key publications and major ideas are listed in Table 2-5.

Table 2-5: Major Ideas in Theoretical Foundation of Lean Service

Author/s	Major Contribution
Bowen & Youngdahl (1998)	The convergence of service and manufacturing production orientations and Lean Service Characteristics
Poppendieck (2002)	Universality of lean principles and their application to software development, providing a broad framework for improving software development
Allway & Corbett (2002)	Tailored transfer of production-line approaches from manufacturing to services.
Ahlstrom(2004)	Contingencies to the applicability of lean production to service companies
May (2005)	Framework of Lean Knowledge Principles
Womack & Jones (2005)	Six principles for Lean consumptions with an aim to solve customers' problems.
Abdi et al., (2006)	Assesses the use of 'lean approach' in services industry with emphasis on human element.
Liker & Morgan (2006)	Illustrate the management principles of TPS as a true systems approach effectively integrating people, processes, and technology that can be applied beyond manufacturing to any technical or service process.
Radnor & Walley (2008)	Appropriateness of Lean as a methodology for achieving real, sustainable cost savings in the public sector
Brandao de Souza (2009)	Agreement regarding potential of lean healthcare as it leads to sustainable results.
Seddon et al.,(2009)	A 'systems' service management archetype for managing service in such a way as to see and remove waste continuously
Wei(2009)	How Lean principles can offer new insights to existing service theories
Kundu et al., (2011)	Comparing and finding the compatibility between lean best practices with CMMI-SVC v1.2 model.
Ebert et al.,(2012)	To build a foundation and facilitate alignment on what "lean" means within Software development.
Carlborg et al., (2013)	Suggests promising synergies, as well as important obstacles, for applying lean principles in services
Arfmann (2014)	Lean service transformation is not able to address service operations challenges appropriately. Researchers should search answers for service specific problems and characteristics
Asnan et al.,(2015)	Change management is needed by addressing the resistance, provide support and develop the required knowledge for lean implementation in services.

Different authors have brought up the implementation of Lean manufacturing principles to service organisation among which can be found: the elimination of waste, value stream, pull, continuous improvement, human centric approach, people partnership etc. These ideas have led to increasing reliability, quality, delivery and efficiency in service processes. Bowen & Youngdahl (1998) suggested the emergence of mass customization as a "common industrial paradigm" representing the convergence of basic manufacturing and service. Using the hard and soft tenets of lean manufacturing the authors were able to reconcile the alleged tradeoffs between efficient low-cost operations and flexibility leading to improvement in focus on customer service, quality and superior service/differentiation.

While the larger number of articles talked about five Lean principles given by Womack & Jones (1996), none of the articles exhibited the use of Lean Tools like 5s, just in time (JIT), and jidoka in services. However, many authors agreed that all Lean tools cannot be adapted to services and lean transfer in services needs a tailored approach. Allway & Corbett (2002), George (2003) and Ahlstrom (2004) believed services are a slow process because of inessential complexity in the processes and stressed on using lean to identifying and quantifying these Non Value Added (NVA) activities or waste, and eliminating them.

Womack & Jones (2005) suggested fundamentally an altered approach to solve the arising dilemma of consumers having variety of choices to make and more products to manage with decreasing time and energy by identifying Lean consumption principles. The principles seek at looking at the total cost from the consumer's perspective and prompting service providers to optimise the process of consuming (Liker & Morgan, 2006; Ballé & Régnier, 2007). Seddon et al., (2009) emphasised using lean as true systems approach not just a tool box. The authors asserted on successfully integrating people, processes, and technology for successful adoption of Lean in services. As Toyota Vice-Chairman Fujio Cho explained it: *"The key to the Toyota Way and what makes Toyota stand out is not any of the individual elements. But what is important is integrating all the elements together into a system. It must be practiced every day in a very consistent manner-not in spur"*, (Liker & Morgan, 2006).

As services are delivered for the people by the people, hence the human element turns out to be an important element in the service sector. Various authors Bowen & Youngdahl(1998), Spear & Bowen (1999), Poppendieck (2002), May (2005), Abdi et al., (2006), Seddon, et al.(2009), Malladi, et al.(2011), Bortolotti et al., (2015) have affirmed the importance of the human dimensions of motivation, group problem solving, empowerment, training and respect for people. Alongside this, commitment is needed from the management as Lean practice is not just a tool, but rather a strategic move towards cultural transformation.

Authors like Arfmann (2014) and Moraros, et al, (2016) have doubted the benefits of lean in services citing the lack of rigorous empirical studies. They have stressed the need for developing lean as per the unique characteristics of services. Impact and effectives of lean in services can be gauged by more rigorous, higher quality and better executed scientific researches.

2.4.2.2 Frameworks/ Models of Lean service

Closing in towards becoming a Lean service organisation is an extensive and long-term venture. A model/framework is needed as the fundamental aspect of such a venture for guiding and tracking the progress made. Traditional measures are not suitable as they stress only financial measures and may hinder process improvement (Swank 2003; Bhasin & Burcher, 2006) and are insufficient for critical decision-making information that is required in current competitive and volatile market environments (Fullerton & Wempe, 2009). The adoption of lean measures prompts the organisations to expand the use of non-financial manufacturing performance measures thus aiming to grant pertinent, actionable information to employees working in environments focussed on flexibility, quality, and responsiveness (Fullerton & Wempe, 2009). The model acts as a guide and checks whether the adoption of lean in services is progressing as outlined or not and augment the financial measures. Number of instruments and models methodised in key construct categories were reviewed and analysed. The framework can be classified as a design/conceptual framework and an implementation framework as suggested by Anand & Kodali (2009) and Yusuf & Aspinwall (2000). The review of the literature imparted 18 frameworks/models for Lean in services. The search was made using keyword ‘framework’ and ‘model’. The frameworks found implicit in case studies like e.g. Cuatrecasas (2002), Apte & Goh (2004), Radnor (2010) etc. were also included.

Yusuf & Aspinwall (2000), when reviewing the frameworks of total quality management (TQM), explained that “a model” answers the question of “what is TQM”, with the concept or essentials put down together, whereas “a framework” answers “how to” questions and provides the way forward. Thus, using these definitions the reviewed frameworks in Lean services were classified into “design/conceptual frameworks” (similar to that of “models”) and “implementation frameworks. Thus design/conceptual frameworks illustrates only “what is Lean” and putting down its essential elements not emphasising on “how to” i.e. implement part of the model. The implementation frameworks not only illustrates “what” but also emphasis on “how” to implement it by giving step by step approach Tables 2-6 and 2-7 depict the classification schemes for different frameworks.

Table 2-6: Design/Conceptual Frameworks of Lean Service

	Category	**Design/Conceptual Framework k**		
S. no.	**Framework of LM**	**Author**	**Industry**	**Concept Identified**
1	Framework for Sustainable University	Comm & Mathaisel (2003)	Education	Lean adoption for sustainable university in USA.
2	Translating Lean Production principles to services	Ahlstorm (2004)	Services	Framework developed by Karlsson & Ahlstorm (1996) for lean production was translated into service companies.
3	LM Principles to Information Intensive Services	Apte & Goh (2004)	Information Intensive	Assessing level of lean service adoption focusing on reduced inventory & lead time.
4	Lean Indicators for Operation Management in Services	Sa´nchez & Pe´rez (2004)	Services	Adaptation of measures covering different dimensions of lean by including indicators of lean practices.
5	Flow Model	Kollberg et al. (2007)	Health Care	Flow model which needs to be balanced with other measurements.
6	DEB-LOREX Model	Sarkar (2008)	Service	A Management system for achieveing organisation excellence using the principles of lean.
7	House of Lean	Radnor (2010)	Public Sector	"House of Lean" representing some of the lean tools and techniques used for assessment, improvement and monitoring.
8	ILL (Innovativeness, Learning & Lean) Model	Dahlgaard, J. J. et al.(2011)	Health Care	Based on a '4P Excellence Model' having People Management, Partnerships, Processes and Product/Service Results.
9	Unified Model for Lean & CMMI	Kundu & Manohar (2012)	IT	Model integrates lean with CMMI.
10	Assessing Lean Service Adoption	Malmbrandt & Ahlstrom (2013)	Services	Developed and validated in an iterative process to assess lean service adoption.

Table 2-7: Implementation Frameworks of Lean Service

	Category:	**Implementation Framework**		
S. no.	**Framework of LM**	**Authors**	**Industry**	**Concept Identified**
11	Rapid response and high efficiency service by lean production principles	Cuatrecasas (2002)	Telecom	Proposes a methodology for implementation of lean management in a services production system.
12	LEAN Service model.	Abdi, et al. (2006)	Services	Implements lean in four dynamic phases: a) Learn b) Expect c) Analyse d) Navigate
13	Implementing lean in multinational Consulting processes	Bonneau (2011)	Consulting	Analyses, describes and reflect upon a study made at consulting company.
14	Lean Transformation F/W for S/W Intensive Cos.	Kuusela & Koivuluoma (2011)	IT	Highlights the significance of learning, iterative execution and holistic approach.
15	Service Strategy Scorecard - an Integrated Approach for Lean Service Engineering and Service Improvement	Kreuzer, et al. (2011)	Services	Handling service improvement and innovation in a new holistic and systematic manner.
16	SVSM (Services Value Stream Management)	Bonaccorsi (2011)	Services	A six step procedure: 1) commit to lean; 2) learn about lean; 3) choose the value stream to be improved; 4) map the current state; 5) identify the impact of waste and set the target for the improvement; 6) map the future state
17	Assessing Lean Deployment in Healthcare	Guimarães & De Carvalho(2012)	Health Care	4 stage model developed following the Shingo Prize.
18	A framework for implementing Lean Management in service companies	Damrath (2012)	Service	Lean implementation in three phases each requiring different lean tools and methods.

As illustrated in the tables above, some authors’ Sa´nchez & Pe´rez(2004), Dahlgaard et al., (2011), Malmbrandt & Ahlstrom (2013) had attempted in producing empirical case studies supporting their framework, the remainder of the articles continue to take on a conceptual approach with little or no empirical support. Thus there is a apparent gap when it comes to defining and profiling the framework of Lean service.

The frameworks/models lack comprehensibility as not any has given a comprehensive list of Lean elements. Many frameworks listed five to eight Lean elements and have given no guiding principles regarding use of Lean tools and practices. No single framework/model in the tables 2-6 and table 2-7 can be taken as a complete reference to Lean service; however, there are some frameworks/models which can be implemented as per the nature of the service. Majority of the frameworks are sector specific or organisation specific, and thus suffer from limitations of external validity. The need is to validate them through exhaustive exploration for their adaptability to other sectors or organisations in services.

Reorganising the culture, value system and organisation’s way of doing business and its people are the most challenging facet of Lean Management. But none of the frameworks has talked about the relationships between different Lean elements and stakeholders. Lean production alters how people work but not always in the ways people think (Boyer, 1996). As responsibility shifts down the ladder, the jobs become challenging and people more productive; how the relationship between organisation and its people alters is a question to be mulled upon.

2.4.2.3 Application of Lean services

This category includes various case studies talking about lean implementation done by both academics and practitioners in service organisations in different sectors. The category is further sun divided sub-categorised into the type of service-sector on the basis where the Lean was applied and which was then published as a case study either in the academic literature or for the practitioner audience. Thus the category is thus classified into sub-categories of Health, Education, IT/ITES, Financial Services, Public Sector Services and

Others. The articles in this category (see Figure 2-7) reveal that Lean management is as befitting in complex knowledge work as it is in assembly-line manufacturing and continuous emerging number of papers in the literature reinforces this view.

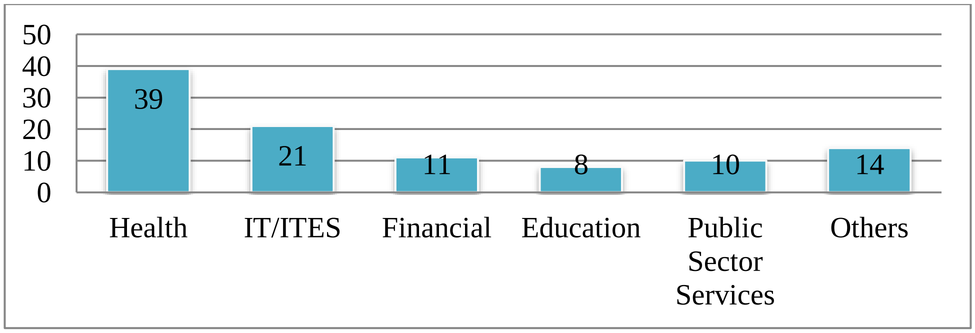


Figure 2-7: Papers Published on Lean in Services by sub categories

2.4.2.3.1 Healthcare Services

Of the six sub-categories healthcare sector, is the one with the most published papers (Figure 2-7). A study by Brandao de Souza (2009) reported that most of the Lean initiatives in healthcare have occurred in the US (57 percent) or in the UK (29 percent). Most cases reported focuses primarily on applying Lean techniques and tools to a unique process or functional area rather than implementing a Lean philosophy in the whole organisation (Mazzocato et al., 2010).The majority of case studies refer to particular departments of hospitals like pharmacy (Al-Araidah et al., 2010), radiology (Kruskal et al., 2012), pathology (Condel et al., 2004) , nursing (Johnson et al., 2012), ward (Ballé & Régnier, 2007) and emergency (Timmons et al., 2014) ; and it relates mainly to the flow of material or patients. Table 2-8 illustrates the major work done in lean in healthcare across the globe in last decade. From the table one can conclude that the Lean principles of gradual and continuous improvement and staff empowerment make Lean adaptable to healthcare settings.

As Toussaint and Berry (2013) state, the advantage of innovation through Lean's proven methods provides hope for better health care at less cost rather than worse health care at less

Table 2-8: Literature in Lean healthcare, practices/tools used, benefits achieved

Authors	Area of Lean Implementation	Lean Practices/Tools	Benefits
Sunyog (2004)	Chain of Laboratories in Florida.	Process mapping, waste elimination, single piece flow & inventory management	Reductions in cost
Kim et al., (2006)	Post Operative Care, MRI& CT Scan, Laboratories Test	Standardizing and mistake proofing the process of ordering, delivering, and administering medications.	Decreased incidence of ventilator-associated pneumonia. Improved patient access by reduction in waiting time for tests, reduction in turnaround time for pathology reports.
Fillingham (2007)	NHS Hospitals, UK, Trauma Care	Voice of Customer (VOC), 6S, pull, created culture of identifying &solving problem, VSM, 1piece flow, standard work, RIE.	Improvement in access time for services and quality of physical environment. Reduction in mortality rate, reduction in length of stay.
Al-Araidah, et al. (2010)	In Patient Pharmacy	DMAIC, 5S	Savings of >45% in the drug dispensing cycle time
Van Leeuwen & Does (2010)	Medium Size Teaching Hospital, Netherlands	VOC, Cause& Effect Diagram, VSM, Kaizen, Standardise Work, Visual Management.	Reduction in length of stay of patients with a total hip replacement resulting into more beds per year and cost benefits.
Radnor (2011)	3 hospitals, UK. Short Stay Unit, Pathology, Accidents & Emergency Theatres, Fracture Clinic.	Rapid Improvement Events (RIE), VSM, Waste Removal, VOC, Demand and relationship with capacity, Staff Engagement	The levels of demand and the relationship with capacity/ resources were well understood and, team working had improved using the RIEs. Culture of analysing cause and effect instead of fire fighting.
LaGanga (2011)	OPD	VSM, Process and flow analysis, Standardise process.	Expansion in service capacity, reduction in no show leading to improvement in accessibility & timely access to services.
Meredith et al. (2011)	Operation Theatres	Process Mapping & Analysis using Video, Standardisation of process, Layout.	Reduction in change over time, Improved productivity
Al-Hakim & Gong (2012)	OT	VSM, Standardise process	Reduction in operative time, the waiting lists for elective surgery and medical errors. Increase in utilisation of OT.

Authors	**Area of Lean Implementation**	**Lean Practices/Tools**	**Benefits**
Díaz et al. (2012)	OT and OPD	Early triage, VSM, Process Simplification, Poke Yoke, Waste reduction and elimination.	Balance demand and supply, cost efficiency, higher productivity
Morrow et al. (2012)	NHS, UK	Shared Learning, Creating Solution, Employee Engagement, Communication, Cross functional team	Improved quality of care, improved efficiency and patient's experience.
Yusof et al. (2012)	Health Information System, Anaesthesia Dept in Malaysia.	VSM, A3 Reports, Standardisation	Reduction in waste and data redundancy. Increased collaboration and teamwork.
Burgess & Radnor (2013)	NHS, UK	VSM, Kaizen, RIE, continuous improvement, process capability, flow and employee development.	Growth in systematic implementation of Lean in English trust hospitals.
Chiarini (2013)	Patient transportation and associated cost.	spaghetti chart, value stream mapping and activity worksheet	Reduction in the average lead time of the patient from the emergency department to hospitalisation or discharge. Cost reduction.
Toussaint & Berry (2013)	USA Hospitals	Continuous improvement, VSM, value creation, unity of purpose, respect for front-line workers, visual tracking, and flexible regimentation.	Increase in on-time starts, Decrease in operating room turnaround time, number of cases rescheduled due to late start and in same-day surgery cancellations.
Bhat et al. (2014)	OPD registration time	VSM, fishbone diagram, Gemba, team problem solving, Waste reduction and elimination.	Reduction in Cycle time of the process 3 to 1.5 min. Reduction in patients' average waiting time by 94% & in queue length by 91%.
Sanders & Karr (2015)	Laboratory of 1,000 bed tertiary care teaching hospital	Kaizen, Gemba, VSM, DMAIC, Root cause analysis, Visual Management	Reduction of turn-around-times (TAT) for ED (Emergency Dept.) specimens. 30% decrease in complete blood count analysis (CBCA) Median TAT, a 50 % decrease in CBCA TAT variation.

cost. In the present era, this is paramount as customers are more knowledgeable thus demanding better quality at lower prices. Blackmore & Kaplan (2016) viewed that Lean addressing quality and the patient experience first rather than may enhance adoption of the methodology through increased staff buy-in. Cost-saving may then follow from improved patient outcomes, and from better employee engagement, productivity and efficiency. The majority of the publications are the case of a particular hospital which is shared with the readers as success case stories rather than studies. Review further revealed that while there are numerous studies illustrating Lean implementation in single healthcare units, only small amount of research is available on how Lean can be diffused in the entire hospitals. But this does not diminish the application of Lean in health care as all work is a process which can be improved using Lean management.

Lean implementation in healthcare is popular across the globe; practitioners are adopting different ways in implementing lean from tentative exploration to systematic approaches aligned with organisational strategy. Lean methodology needs to be adapted and developed so that it becomes owned by healthcare staff and focused towards the goal of improved patient care (Fillingham, 2007). Though lean cannot be termed as a magic potion against underperforming hospitals but lean do seems to have the potential to improve organisational performance.

2.4.2.3.2 IT/ITES Services

Middleton (2001) and Poppendieck (2002) were the pioneers advocating Lean thinking and the use of its tools in IT. Lean attained impetus in IT/ITES due to pressure from the global recession in 2008 as the focus shifted more towards cost cutting and improving the bottom line (Jailia et al., 2011). McKinsey & Company also advocated use of lean stating that implementation of Lean principles in IT can increase application development and maintenance productivity by as much as 40%, simultaneously improving the quality and speed of execution, (Kindler et al., 2007). Table 2-9 demonstrates the major work done in IT/ITES sector under lean. The review divulges that majority of papers are non-empirical and many lack information about context, design of study, barriers in implementation of

Lean and so on. Largely the articles had talked about two things. First, how the four principles of Lean by Spear & Bowen (1999) or the five principles in Lean Thinking by Womack & Jones (1996)can be applied in IT and demonstrating the seven wastes as defined by Ohno in manufacturing in IT (Staats et al., 2011; Ebert et al., 2012; Pernstål et al., 2013). Secondly, the case studies have talked about blending Lean with other quality improvement techniques like Capability Maturity Model Integration (CMMI), Six Sigma, and Agile with the focus on quality or process improvement. Kundu et al., (2011) have presented the compatibility between Lean and CMMI-SVC v1.3 practices. Benefield (2009), Petersen & Blekinge (2010) and Wang, et al. (2012) have studied Lean and Agile software development. Lean methodology has been investigated in IT call centres by Piercy & Rich (2009a) and Laureani (2012) and in software development by Staats, et al. (2011). Petersen & Wohlin (2010) put forward the Software Process Improvement through the Lean Measurement (SPI-LEAM) method to gauge the performance of the development process and take continuous actions to attain a more lean software process progressively.

The review revealed that the authors believed Lean IT will enable organizations to reduce cost, improve service quality, enhance customer satisfaction and achieve accurate business agility. As Hanna (2007) pointed out the difference lean provides is how an organisation learns through improved problem solving, coordination, standardisation and empower people to take decisions and make recommendations. From the review, one can conclude that research on Lean in IT/ITES is at a budding stage. Many organisations have adopted various improvement methodologies for fighting the competition and conserving their position in the market. As the adopted methodologies lead to reduction in NVA activities and are customer focused or value driven we can put them under the umbrella of Lean. There is very little evidence available in literature for practitioners wanting to implement lean methodology for improving large-scale software development, mainly when it extends to inter-departmental exchanges during development. There is a need for more empirical-based research in this area.

Table 2-9: Literature in Lean IT/ITES, practices/tools used, benefits achieved

Authors	**Area of Implementation**	**Lean Practices/Tools**	**Benefits**
Benefield (2009)	Software as service delivery model	Poka Yoke, Jidoka, Kaizen, JIT	Reduction in defects and rework, increase in release velocity, improved uptime.
Piercy & Rich (2009a)	3 UK call centres	VOC, VSM, Change team, Cross Skilled worker, Training.	50% reduction in the average time to complete a customer enquiry. Radical reduction in amount of wastage & unnecessary activity in serving the customer leading to considerable savings in cost and improved customer service delivery.
Laureani et al. (2010)	Call Centre	VSM, Pareto analysis, Root cause analysis, Gemba	Increase in first-call resolution ratio, reduction in operator turnover and streamlining of processes.
Staats et al. (2011)	Indian Software Company	Training, VSM, Standardisation, Visual Control Board, single piece flow, Heijunka, streamlined communication, structured problem solving	Lower variability in performance, improved quality of project, fewer defects, less rework, improved operational performance.
Malladiet al. (2011)	Software Services Company	VOC, Standardisation, Resource Planning & JIT, Waste removal, Learning & best practices, continuous improvement, robust partnerships.	Improved efficiency, reusing knowledge towards continuous improvement, and increase in productivity of resources and of organisation as a whole.
Prochazka et al. (2011)	Scandinavian IT service provider	Agile, Trainings, root cause analysis, visual dashboard,	Improved value chain, flexible value delivery to customer, higher team satisfaction, increased innovation and reduced time to market.
Holden & Hackbart (2012)	Health Services IT Dept.	RIE, work standardization, VSM, Gemba, seamless flow, participatory problem solving.	Improvement in first call resolution, decrease in reopened requests.

2.4.2.3.3 Banking and Financial Services

Swank (2003) has pointed out how Jefferson Pilots , a financial company achieved reduction of 26% in labour costs and 40% in the costs resulting from errors and subsequent corrections and re-work of insurance policies by using the principles of Lean. Apte & Goh (2004) used lean principles like value, effective management of supplier relations &information flow, elimination of waste, appropriate matching of service capacity to customer-driven demand and continuous improvement (kaizen) to minimise cycle time of insurance claims. Delgado, et al. (2010) study of GE money recognised that use of lean approach lead to reduced operational costs, improved processes, better quality of product and increased efficiency thus outweighing the cost of adoption. Gong & Janssen (2015) pointed out not only advantages of Lean service innovation in banking but had drawn draws attention to the risks due to inability of following lean principles. Authors have also suggested the methods to mitigate these risks. Authors of have further emphasised on top management commitment, training of employees and change in culture as crucial for successful implementation of lean. Table 2-10 outlines the work done in area of lean banking and financial services.

Facing stiff competition as the result of globalisation and to uphold their position financial services need to improve upon their operational inefficiencies, leading to reduction in cycle time, waste and rework. Different case studies have proved that Lean with its distinctive characteristic of making process flow visible can produce breakthroughs, especially in an environment where visibility of the process is meagre. Value stream mapping as lean tool leads to visualising the process giving remarkable insight into the value stream and exposing a lot of inefficiencies.

Table 2-10: Literature in Lean financial services, practices/tools used, benefits achieved

Authors	**Area of Implementation**	**Lean Practices/Tools**	**Benefits**
Swank (2003)	Life insurance and annuities	VSM, Standardisation, Takt time, Load balancing, setting performance goals, Visualisation	Halved the time to issuance of policy, 26% reduction in labour cost, 40% reduction in errors which lead to re issuance of policy.
Apte & Goh (2004)	Insurance Claim handling	Identifying, enhancing, and implementing value, effective management of supplier relations & information flow, elimination of waste, appropriate matching of service capacity to customer-driven demand, kaizen.	Reduction in loss payout, high quality information available to claim rep, reduction in the pending claims volume, the caseload, and the closing age of claims, reduction in cycle time.
De Koning et al. (2008)	Multinational Insurance companies	5S, Visual Management, Pull, One piece flow, Communication, Standardised work ,Cellular production, SMED, Complexity reduction, line balancing ,critical path analysis, Quality Control System, Employee Engagement	Information requests per application dropped from 5.5 to 2.6. Average total waiting time of IRs dropped from 21.5 to 12.3 days. This resulted in the estimated savings of €260k/yr. The errors percentage in the internal check & external check decreased to 8% and 12% respectively producing savings of €180k/year.
Delgado et al. (2010)	Financial Services	VOC, voice of the employee (VOE), VSM, business process management system (BPMS), QFD, FMEA, fishbone analysis	Increased productivity, improved revenue, increased customer satisfaction and servicing more customers.
Berger (2013)	Banking	Process standardization, NVA activities discontinued, avoiding redundancy, empower employees process simplification,	80% of the time saved had a direct, positive effect on the budget. More efficient processes ensured that capacities increased at a significantly lower rate than the volume of business.
Gong & Janssen (2015)	Multi-national financial organization	Value, flow and pull, think systematically, continuous improvement, standardize process, knowledge integration, kanban, visual control boards,	17 per cent decrease of operating costs, quick reaction to customer wishes

2.4.2.3.4 Education Sector

Dahlgaard & Ostergaard (2000) were the first to relate organisations in higher education with seven types of waste and five Lean principles. Emiliani(2004) has applied lean tools like 5s, standardised work, JIT, visual control etc. to the design & delivery of a graduate business course, which led to improved consistency between what was taught in the course and how the course was taught resulting into improvement in the quality and relevance of course materials, and delivery of higher value as perceived by students. A case study by Doman (2011) demonstrated that lean principles and practices process mapping, kaizen, value, waste, 5S utilized in industry can be successfully applied to improve higher education administrative processes through an innovative and engaging learning experience involving undergraduate students. Isaksson et al., (2013) identified seven waste and suggested how five lean principles can be applied in traditional university education and research for reduction of waste. Vijaya Sunder M. (2016) has explained how lean along with six sigma was leveraged to improve the university's library process.

Applications of Lean principles in education have made course programme more pertinent and stepped up its delivery. Customisation and quicker speed has led to vast enhancement in the knowledge intake for students. The review concluded that educational institutions are good claimants for implementation of Lean leading to significant reduction in wastes and improvements in terms of quality of services.

Table 2-11: Literature in Lean education, practices/tools used, benefits achieved

Authors	**Area of Implementation**	**Lean Practices/Tools**	**Benefits**
Emiliani (2004)	Business School courses	5s, standardised work, JIT, visual control	Improved consistency between what & how the course was taught .Improved quality & relevance of course materials, delivery of higher value.
Comm L. & Mathaisel (2005)	Higher Education	Customer Focus, Optimized flow of services & use of capacity, Seamless data flow, Employee Empowerment.	Reduced waste, improved operational efficiency, & contributed to sustainability
Doman (2011)	Higher education Administrative processes	Process mapping, kaizen, VSM brainstorming, teambuilding, 5S, value vs. waste, & A3 Report	Small group of UG students quickly learnt & applied lean to improve university administrative processes.
Isaksson, et al. (2013)	University education and research	Identification & elimination of waste, VSM, Standardisation	Reduction in delivery time of knowledge, permitting flexible speed of studies, packaging sizes of courses as per need.
Vijaya Sunder M. (2016)	Library of Higher Education Institute	Waste Analysis, Root cause Analysis, Visual Management, Standard operating procedures	Reduction in book search time, imbibing the Quality Excellence mindset among students.

2.4.2.3.5 Public Sector Services

Public sector services though having education and health too in its gamut is considered separately. Firstly it has more diverse customer group (experts, politicians, citizens etc.) hence it is difficult and complex in public sector to define what the customer values, this makes service design difficult. Secondly, lack of competition and non-profit motive makes many public sector service providers believe they have no reason to pursue lean management. Thirdly, public-sector organizations are controlled by political forces rather than market forces. On one hand they need to balance delivering the best to customer along with providing basic services to people lower down the order hence the need is to balance the diverse needs. Process ownership is missing along with skills to visualise process as whole. In past few years the demands on efficiency and quality in the public sector services have increased which have raised the need for process improvement methodologies in it. Lean can certainly help in improving quality and delivery of public sector services but these aspects have to be kept in mind.

The implementation of Lean thinking in the public sector was debated by the majority of the articles published, in the journal Public Money and Management, in February 2008. Various authors agreed over the applicability of Lean thinking into public sector management, with certain adjustments. Public sector has more diverse customer group (experts, politicians, citizens etc.) hence it is more difficult and complex to define what the customer values. Radnor & Walley (2008) analysed a series of case studies of Lean in the public sector around four themes—process-based view, focus on value, elimination of waste and employee-driven change. The authors warned against the danger of focusing only on tools and visualising RIEs as ‘Lean’ and so little effort is placed into sustainable activities such as developing a culture of structured problem solving. They have emphasised on having process view, understanding capacity and demand and, linking improvement activity to strategy in place for long term sustainment of benefits of lean. Barraza, et al. (2009) empirically proved the improvement in the services provided to the public by local councils in specific Spanish contexts by the application of lean thinking. Tang, et al. (2010) proposed that E-government based Lean public management can change the municipal government institutions by enabling the public more access to the government, and thus makes the government working process transparent, accountable and citizen-centric. Various other authors such as Radnor & Boaden (2008), Radnor Z. (2010), Sua´rez-Barraza & Ramis-Pujol (2010), Pedersen & Huniche (2011) and Radnor & Johnston (2013) explored successful Lean applications in different cultural and working-environments in public settings as described in table 2-12 below.

Most of the articles studied in this category gave new insights into favourable results in terms of improvements in the quality of public services, improvements in timeliness of client response, cost savings, etc. They also pointed out future efforts and directions for implementing lean management in the public sector.

Table 2-12: Literature in Lean public sector, practices/tools used, benefits achieved

Authors	Area of Implementation	Lean Practices/Tools	Benefits
Radnor & Walley (2008)	Eight case studies in Public Sector	Process based view, Focus on Value, Eliminate waste, Employee driven change, RIE	Improved productivity, reduction in cost , delivery of a high-quality service meeting customer requirements
Barraza et al. , (2009)	Local Councils, Spain	5S, Gemba, kaizen workshops and process mapping.	Improvement in work processes, saving space and resources, reducing time of response to requests for service and a general improvement in the public services offered to the community.
Radnor (2010)	HM Revenue and Customs, UK	Visual Management, Process Mapping, Standardise work, Problem solving, team building.	Improvement in productivity and quality as well as clearer understanding of the process and the levels of waste.
Sua´rez-Barraza & Ramis-Pujol (2010)	HR service process, Mexico	Gemba, waste elimination, flow diagram, team problem analysis,	Improved cycle times in the human resource selection and hiring process and adopting standard procedures. 77.7 percent of NVA activities were eliminated
Tang et al. (2010)	Municipal Services, China	Problem solving culture, root cause analysis	Improved internal efficiencies and better services to their citizens
Arlbjørn, et al. (2011)	Danish municipalities	Waste elimination, kaizen, value stream mapping, visual boards, work flow analysis	Less stress, easily planning of workload, throughput time reduction avg. 50 per cent
Pedersen & Huniche (2011)	Danish Public Sector	Kaizen, VSM, Standardise,	Role of manager in lean implementation, role of negotiations
Radnor & Johnston (2013)	HM Revenue and Customs and HM Court Service, UK	Customer focus, standardise work, daily meetings, process based view	improved quality and productivity, made processes clearer and led to new ways of working by considering process design and introducing standard processes

2.4.2.3.6 Other Sectors

In addition the five categories discussed above, Lean is applied in other services too like hospitality, HR, telecom, etc. Cuatrecasas (2002) has provided a methodology for implementation of Lean management in the case of telecommunication services. The study includes analysis of the variability as characteristic of services and talks about a proposal for action to be taken when it is excessive. According to Thomsen (2006) lean can assure the need of Telecom operators of cost reduction and helps them to focus on the vendor-side rather than just the technological-side of the business as the means of sustaining in a competitive environment. Higgins (2007) and Benders (2012) have talked about the application of Lean in HR processes. Jekiel (2010) emphasised on the role of business partner the HR department is playing as to help and motivate other departments to get continuous improvement to prosper. One can conclude that the lean approach is applicable in the service context and can be a valuable addition to services improvement leading to customer satisfaction.

2.5 Lean Tools and Practices in Services

Once importance of lean management in services has been established; it is important to know the Lean practices and tools which are being applied in services especially when we say services are different from manufacturing. Lean tools and practices can be defined as techniques developed and applied in Lean Philosophy (Leite & Vieira, 2015). Value stream mapping, eliminating waste, standardisation, visual management/visual control, 5S, HR management, Gemba and Kaizen are important improvement tools in services (De Koning et al., 2008; Barraza et al., 2009; Radnor , 2010; Staats et al., 2011; Chiarini, 2013; Isaksson et al., 2013). Along with these lean management seeks to create a culture where looking for, and solving, problems are the custom rather than simply working around them as is all too often the case.

One of the tools widely used for learning about processes is **Value Stream Mapping** (VSM). It is an enterprise wide improvement technique to visualise an entire production/service process by representing information and material flow, and to improve the production/service process by identifying waste and its sources (Rother &

Shook, 2003). VSM helps in engaging front-line staff (Fillingham, 2007) by creating interconnectedness (Bushell et al., 2002), leading to thinking of the organisation as an integrated and inter-related system (Barraza et al., 2009) visualising stages or processes (Piercy & Rich, 2009a), thus helping to eliminate waste/muda and simplifying the process (Staats et al., 2011). VSM leads to improve productivity and competitiveness, and help people implement system rather than isolated process improvements (Emiliani & Stec, 2004). There are two type of VSM i.e. current state and future state map. The "current-state" also called as "as-is" VSM portrays the current way in which material and information flow and are processed. Future-state VSM portrays a future condition that embodies improvements yet-to-be-done. Eliminating NVA activities helps in people's efforts being focused on the value creating activities that customers' want and are ready to pay for. This ultimately leads in enhanced business processes due to lesser error or defects rates, shorter lead-times, shorter cycle time, and lower costs.

5S, the foundation of lean (Barraza et al., 2009), is another tool addressed a lot in the literature. It is a way to certain that orderliness is built in to the day-to-day way of doing things. The tool paves the way for infusing what needs to be daily discipline (Fillingham, 2007), thus assuring process stability and sustaining Leanness. 5S is a series of activities (sort, set to order, shine, standardize, and sustain) acting as beneficial tool for organizing workspace in the safest and the most efficient way, by distinguishing and storing the things needed, maintaining the work area and items, and preserving the new order. It acts a solid foundation on which continuous improvement is build. It also leads to employee empowerment giving them sense of ownership, participation & responsibility. It results into improved safety, lower defects rates, improved throughput, improved employee morale and enhanced image to different stakeholders.

Standardising process helps in elimination of NVA activities and development of employee empowerment (Radnor , 2010). Standardised work is a tool for developing, confirming and improving our processes (Pascal, 2007). Lack of standardisation leads to costlier service processes as they have higher error rates and decreases overall responsiveness and customer satisfaction. Driving the Lean process and rigorous standardisation requires people who work towards a solution that can be broadly adopted and disseminated for use as a standardized solution assist all workers facing similar situations (Kim et al., 2006; Liker & Morgan, 2006). Standardisation induces process stability, organisational learning, identify and problem solving and employee involvement. It acts as a basis for continuous improvement.

Visual management is an valuable means to highlight the status of work in process, solve problems of process invisibility, and help in streamlining communication, thus leading to better problem solving and specifying outcomes (Liker and Morgan, 2006; Radnor, 2010; Staats et al., 2011). It’s more use of pictures and fewer words. The trend charts, schedules, problems, countermeasures and other information which displays the status of the project across all the functional groups are displayed on the walls (Liker & Morgan, 2006). Visual management also measures and monitors the impact on the processes and their improvement. It not only helps manager to track the status and to check whether any team member had been given too much work, but it also allowed managers to identify potential problems sooner and provide targeted assistance as suitable (Staats et al., 2011). Visual control boards and A3 reports are mainly used for visual management. It helps to increase the visibility of standards, procedures, and protocols and make them easier to understand (Sanders & Karr, 2015).

Services are knowledge work intensive sector, where deep technical knowledge is the baseline skill, and Lean is the higher level meta-improvement method that is part of the culture of the company. **Employee engagement** is a crucial part in Lean (Radnor & Walley, 2008). People need to be trained and motivated to build up skills to solve the problems rapidly (Liker and Morgan, 2006; Staats et al., 2011). Employees must be empowered to independently resolve customer problems and issues (Piercy & Rich, 2009a; Delgado et al., 2010; Berger, 2013; Toussaint & Berry, 2013). Indeed employee empowerment and respect for people is the key to the long-term sustainability of any lean programme (Hines et al., 2004 ; Fryer et al., 2007). Employee empowerment motivates the employee to keep raising the bar, leading to learning and innovating organization and people want to be involved directly and an attitude of continuous improvement develops.

Imai Masaaki(1986); the creator of word **Kaizen** defined it as: “a means of continuing improvement in personal life, home life, social life, and working life. At the workplace, Kaizen means continuing improvement involving everyone – managers and workers alike”. Kaizen is derived from two Japanese ideograms: KAI, which means change, and

ZEN, which means to become better. Thus it means continuous improvement. Kaizen has become a universal word. But it is rarely practiced in most organisations as true continuous improvement that spreads throughout the organisation (Liker and Morgan, 2006). The journey towards Lean can be set in motion by implementing a Kaizen effort which is executed out by cross-functional teams focusing on key processes for three to five days with specific goals where the emphasis is on team building and innovation using Lean techniques and tools (Apte & Goh, 2004; Radnor and Walley, 2008; Barraza et al., 2009;Aken et al., 2010). It stresses on incremental improvement, organisational cultural change and employee involvement, in enterprising and sustaining performance improvement. It leads to extensive improvement in lead time, efficiency, productivity along with enhancement of employee skills, attitude towards lean.

The review substantiates that the tools practiced in manufacturing can be enforced in services too. The differences appear to be that of importance, language and understanding of the concepts rather than fundamental differences related to the principles of Lean. Perhaps the key is a greater understanding of what these differences are and how they can be adapted to the services; looking at unique characteristics of services.

2.6 Lean Benefits

The tables 2.8 – 2.12 illustrate benefits achieved by organisations in services from hospitals, insurance companies, software giants, call centre to educational institute. Most of the published applications represent before and after studies with a mix of qualitative and quantitative results. The various studies of Lean in healthcare in NHS (National Health Service) hospitals (Fillingham, 2007; Radnor, 2011; Morrow et al., 2012 ; Burgess & Radnor, 2013), operating theatres (Meredith et al., 2011; Al-Hakim & Gong, 2012), laboratories chain (Sunyog, 2004; Kim et al., 2006; Sanders & Karr, 2015), out-patient departments (OPD) (LaGanga, 2011; Díaz et al., 2012), emergency (Decker & Stead, 2008; Holden, 2011; Chiarini, 2013), nursing (Van Leeuwen & Does, 2010) and surgery (Toussaint & Berry, 2013) proved Lean leads to improved quality of care , speedy delivery, reduced waiting time, reduced hospitalisation duration , improved productivity and efficiency, capacity expansion without additional facility, increased utilisation of facilities available, happier and healthier patients. Lean implementation supported better information flow, improved coordination and communication (Al-Hakim & Gong, 2012). It can act as a foundation for facing challenge of improving patient satisfaction and quality of care in health sector. Authors agreed that lean is not mere a tool box ;for true lean adoption lean need to be deployed systematically by defining value from patients' perspective (Blackmore & Kaplan, 2016) , imbibed in organisational culture aligning with organisational strategy (Hines et al., 2004; Spear, 2005; Burgess & Radnor, 2013) and understanding the "system" dimension (Ballé & Régnier, 2007).

The intangible nature of software, developers as knowledge workers, and the intricacy in defining flow in software development make the implementation of lean principles and practices challenging (Ebert et al., 2012). Yet, the need is there across IT /ITES industries, lean software books are published, lean conferences are conducted, and IT /ITES organizations are keenly adopting lean principles. The administration of Lean in a software service company (Staats et al., 2011) led to lower variability in performance, fewer defects and rework, improved operational performance and quality .The study reported adoption of Lean resulted in a more iterative approach to software development projects versus a sequential, "waterfall" method , reduced hierarchies, sharing mistakes and specialized tools. Lean exercise resulted in a 50 per cent reduction in average time to complete a customer enquiry, an increase in first-call resolution ratio, a reduction in operator turnover , a streamlining of processes, rapid improvements in quality and cost position with minimal investments in call centres (Piercy & Rich, 2009; Laureani et al., 2010; Meredith et al., 2011). Piercy & Rich (2009a) believed that the integration of lean process approaches to traditional services marketing perspectives (such as SERVQUAL, market(ing) orientation, the service profit chain or service-blueprinting) may serve to enhance marketing ability to improve service delivery to the customer. Lean improves productivity as project groups and people become more productive and less focused on fighting fires and operating in crisis mode (Waterhouse, 2008). Lean can act as a survival tool in slump period as by reducing wastes one can reduce delivery time with more efficiency and in less cost (Jailia et al., 2011). Organisation which emphasis on waste elimination and sharing organisation wide learning for continuous improvement benefits by saving and improved efficiency adding more value to organisation and its customers. As Poppendieck (2002) stated fundamental principles of lean thinking viz eliminating waste, empowering front line workers, responding immediately to customer requests, and optimizing across the value chain provide a broad framework for improving software development.

Jefferson Pilot Financial Insurance Company adaptation of Lean (Swank, 2003) led to: halving the time to issuance of policy, a 26 per cent reduction in labour cost, and a 40 per cent reduction in errors. Similarly adoption of lean in an insurance claim company resulted in a reduction in loss payout, the closing age of claims, pending claims volume, and cycle time while increasing availability of high-quality information (Apte and Goh, 2004). In another multinational insurance company it led to a decrease in errors by 12 per cent resulting in annual savings of €440k/year (De Koning et al., 2008). Gong & Janssen (2015) lean implementation in a retail bank helped in quick reaction to customer wishes by releasing new functionality, assisted in experimenting-based approach to gain feedback about the benefits and drawbacks of changes facilitating quick learning.

Doman (2011) agreed upon the lean's potential to improve customer value and eliminate waste in universities. Balzer (2010) illustrates how lean in higher education helps achieve academic and operational excellence by improving university processes and introducing large scale operational change programs. The author further adds how lean assist stakeholders seeking a competitive advantage over other higher education institutions by improving efficiency of its processes. In education Lean led to improved quality, relevance of course materials, reduction in delivery time of knowledge, flexible speed of studies and packaging courses size as per need, and delivery of higher value (Emiliani, 2004; Doman, 2011; Isaksson et al., 2013). Comm L. & Mathaisel (2005) established the recommendations for any higher education institution considering a lean initiative implementation as: educate employees on lean concepts; apply Womack's five lean principles; define appropriate metrics for success; and continue developing outsourcing, collaboration programs, and technology initiatives. Wang et al., (2008) proclaimed that higher education should mull over the adoption of lean practices into their academic curriculum for motivating total personnel participation. Vijaya Sunder M. (2016) case study of lean implementation in improving university process promoted employee engagement, process thinking & practical learning among students; imbibing the culture of quality excellence. It reinforced the views that lean application results into lower defects and higher customer satisfaction.

Lean in public sector service environments can be remarkably advantageous leading to improved processing times, better service quality and performance ; in nutshell ‘achieving more with less’ (Radnor, et al. ,2006). The analysis of Lean in public sector services by Radnor & Walley (2008), Barraza et al. (2009) and Radnor and Johnston (2013) concluded that lean helps in delivering a high-quality service that meets customer requirements with efficient resource utilisation. It leads to improvement in cycle time in selection of human resources in public services (Sua´rez-Barraza & Ramis-Pujol, 2010). Municipalities in Denmark adopted lean for development of organisation and cost reduction (Arlbjørn et al., 2011). Lean thinking was reported to yield improvements in service performance, value work productivity, and employees’ affective commitment in UK public call centres (Jaaron & Backhouse, 2011).

Thus from the above discussion one can easily infer that lean implementation has become progressively universal. Various academicians/practitioners have analysed the lean implementation in service organisations and its effectiveness in improving the quality of service. A lean operating system transforms the way an organisation learns through shift in problem solving, coordination through connections, and standardization. Organisations are adopting it as a cautious exploration or widespread organisational activity or as a systemic approach aligned to strategy. Results or benefits achieved are tangible enough for the organisation to be committed to implementation of lean.

2.7 Status of Lean in Indian Service Industry

Necessity is the mother of innovation (invention). Faced with global competition and demanding native customers Indian service companies are increasingly becoming aware of their function to be responsive to the customer’s changing needs. And trying to perform in line with these changing needs, they are adopting various methodologies to reduce cost, improve quality and making available the desired services to the targeted customers.

Very little research has been carried out relating to the status of lean implementation in the Indian service industry. Díaz et al. (2012) have examined the operations of Aravind Eye Hospital, the largest eye care provider in India. Authors state that the main driver of Aravind’s efficiency is an embedded set of lean services practices facilitated by an early triage process and that a better understanding of these can bring improvements in the healthcare sector. By using lean tools for variability reduction, process simplification and optimising inventory less than 80 doctors do 200,000 cataract operations per year and a non-profit hospital is able to treat two thirds of its patient free of charge.

Govindarajan & Ramamurti (2013) have studied 9 hospitals in India to study how these hospitals are providing world-class health care at ultralow cost. They concluded that to deliver it, the Indian hospitals have developed three powerful organizational advantages: a hub-and-spoke configuration of assets (variability reduction or triage), an innovative way of determining who should do what (simplifying and standardizing processes), and a focus on cost-effectiveness rather than just cost cutting (through task shifting, better utilization of resources and skill development of people).

Das (2011) demonstrated the potential gains in the reduction of medical errors in pathology by using lean TQM approach. Chadha et al. (2012) have developed a transformation model by integrating queuing theory and lean methodology (VSM, 5S visual management, one-piece-flow to reduce service lead time, and adoption of standard operating procedures) which led to an improved process flow, increased capacity and decrease in length of stay for all patient classes in emergency department . Bhat et al. (2014) improved the registration process of the hospital by adopting lean six sigma resulting into reduction of cycle time of the process three to 1.5 minutes, 91 per cent reduction in queue length and 48 per cent reduction in percentage of scheduled utilization of staff for the process.

Staats et al.(2011) through their exploratory work in Wipro proved that lean implementation in knowledge work is possible and that it changes how the organization learns through hypothesis-driven problem solving, streamlined communications, simplified process architectures and, to a lesser degree, specified tasks resulting in improved operational performance. Wipro has improved productivity by 43 per cent and reduced rework from 18 to 2 per cent. Leading BPO firms like Genpact and Infosys use six sigma and lean tools for re-engineering and transforming business processes.

Bharti Airtel has adopted lean six sigma under Business Process Management System (BPMS) initiative. Along with it Process Standardisation, Performance Variance, Reduction (PVR) and Knowledge Management are some of the initiatives which are deeply ingrained in Bharti Airtel's processes.

Axis Bank through its lean management approach titled "Shikhar" has reduced customer wait time for loans by 30 to 70 percent, while its total book value has risen by almost 50 percent—even as hiring and IT investment remain almost flat. Employee quality of life has improved, too (McKinsey, 2014).

Indian Service Industry growing at faster pace as compared to agriculture and manufacturing sectors is the key to make India a part of global power. On one hand with the advent of liberalization and globalization service industry is facing competition from multinational companies. On the other hand advances in technology and the globalization have heightened customer expectations. The other major challenge is to retain and expand our competitive advantage in those services where we have already made a mark as new competitors from other developing countries making rapid strides even in areas where we had the initial advantage as in the case of software services. Thus to compete, the Indian service industry need to be at par with their global competitors and need to adopt lean.

2.8 Research gaps

The chapter reviewed the advancement of published research on Lean Management in Services, to envision what Lean is in services, to categorize the research done and propose gaps for scholars and practitioners to perform future research. Lean means showing a commitment towards continuous improvement using tools and methods for process improvement as well as showing respect for people through leadership behaviours and business practices. The significant conclusions derived out of the review are Lean in services is diverse from that in manufacturing because of the inherent characteristics of services and involvement of customers at various touch points. Although the thinking or philosophy behind Lean principles remains same from manufacturing to services, lean tools and practices need to be adapted for the service industry. Many authors/practitioners have expressed the same point but are silent on what adaptations are needed. The majority of the research on the application of Lean has talked about Lean as a solution for a department or for a specific problem. Researches investigating the lean adoption on enterprise wide scale are missing. For sustainable results, one needs to view services as a system and apply Lean enterprise wide holistically rather than in a piece-meal approach.

It was observed that service industries had been slow to adopt Lean until 2010 after which there was a surge in the number of papers published under Lean services signifying a recent interest in this area of research. A key challenge with services is to manage the intangibility of waste arising because of the difficulty to identify it and the existence of the customer as co-producer. Another challenge to applying Lean in the service industry is the dearth of realisation about the benefits of adopting Lean in service organisation. However, the reviewed literature depicted that the implementation of Lean in services has led to positive results. Using Lean tools like VSM, standardisation, visual management and root cause analysis one can identify and abolish the root causes leading to improved quality of service and enhanced customer experience, expeditiously.

Respect for people and employee engagement are critical to Lean in service as interaction between employees and customer defines and permeates services. Thus, human-centric approach, responsibility along with ownership, deeper problem-solving capabilities and cross-functional relationship is essential for continuous improvement in services.

Lean's sustainability can be ensured by change in culture and organisational values along with the application of Lean tools. Readiness to change and enthusiasm towards adopting novel ways of doing things is essential for successful and sustainable transformation. It is vital to comprehend that Lean is an integrated system of diverse quality management techniques with different definitions, tools and concepts. It is basically a methodology which can help in achieving "More for less for more", i.e. more output with less input for more customers. The need is to standardise the Lean service definition and to develop guidelines for structured implementation in service industry.

Major shortcomings as manifested from the review of Lean in services are illustrated below. These could serve as excellent triggers for future research:

- A need of common definition of Lean services – there is a need to assimilate the contemplation, understanding and application of Lean services to determine an empirical definition tailored for the service industry.

- Although other process improvement practices like Six Sigma have universally established frameworks for structured implementation, there is no such structured framework available for Lean services. Practitioners believe that Lean principles can be applied in services. The lack of standard models/ frameworks for Lean services is another significant area for future research and exploration.
- Meticulous empirical industry-specific studies are the need of the hour as the larger part of reviewed articles is organisation-specific or project-specific lean application following a case study approach.
- Presently, bulk of research on the subject has been performed or reported from developed economies. Developing economies, serving large populations with resource constraints and limited means need process improvement methodologies for more production with lesser resources, cost reduction, quality improvement by eliminating NVA activities. More research is needed in developing economies.
- Many Indian service industries are adopting different lean management tools but the work they are doing is not done in the name of lean implementation. These piece meal approaches in lean practices can be effective in the short run but in the long run these might cause a problem of fitment. Lean is needed to be adopted as a way of thinking with long term vision and not just a tool box.

  The objective of proposed research as identified from the research gaps above are:

  - To develop comprehensive bibliography of lean management in services.
  - To assess the reliability and validity of existing frameworks in selected Indian Service Sectors.
  - To develop a framework for lean management in services.
  - To assess the reliability and validity of proposed framework in selected Indian Service Sectors.

To achieve the above objectives the research plan is presented in the figure 2-8 below.

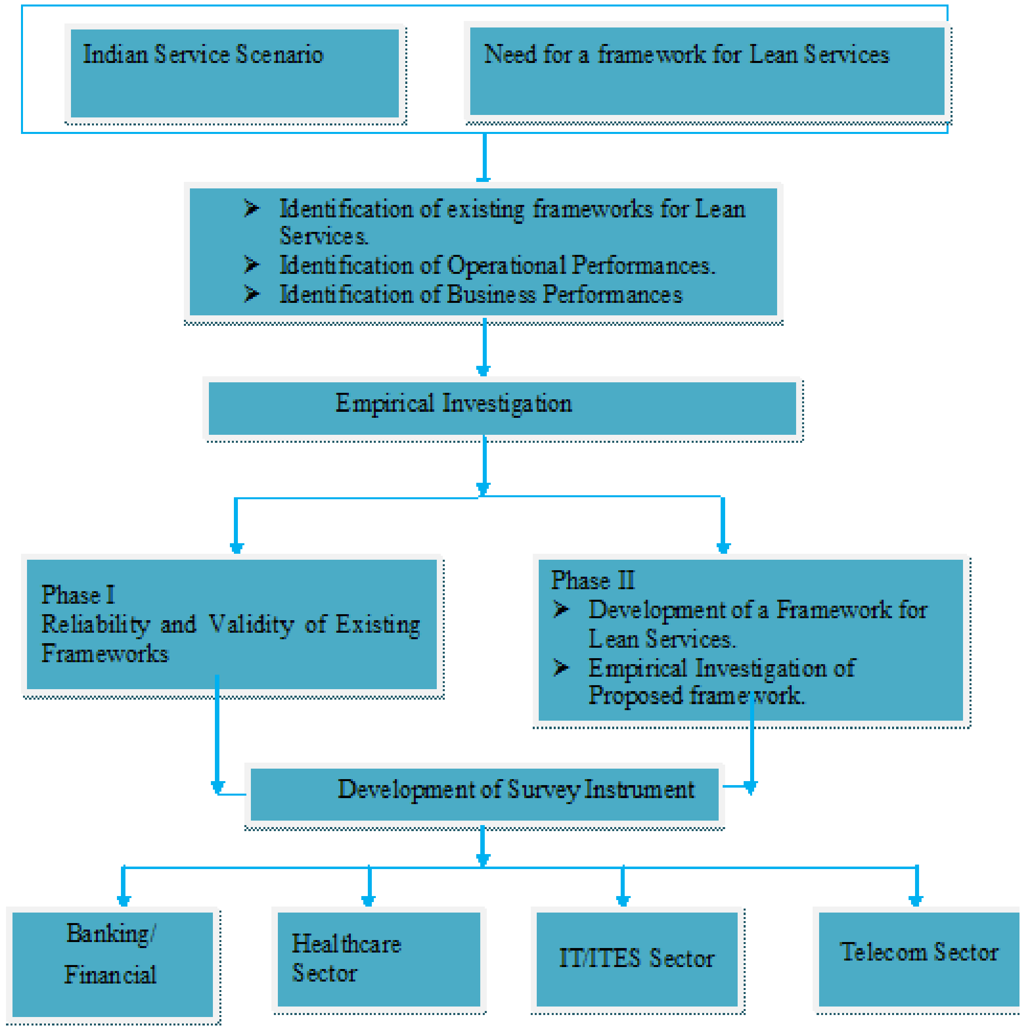


Figure 2-8: Research Plan

2.9 Conclusion

In this chapter comprehensive literature review was done to gain insight into the concept of lean/ lean services and to identify the existing frameworks for it. The state of adoption of lean by Indian services was also examined by review of literature and the need for the implementation of lean in Indian services was identified. The various gaps in the literature were established regarding the competitiveness of Indian service sector and applicability of existing frameworks in Indian services. The objectives of the proposed research were drawn from the identified gaps.

CHAPTER 3: RESEARCH METHODOLOGY

Research design is a framework created to get answers for the research questions. It defines the research type, research problems, hypothesis, experimental design, data collection methods, ethical requirements when entering into the field, statistical analysis of the data along with the role of the researcher during the data collection process (Creswell, 2003). A research design could be seen as a framework or a plan or a blueprint for collecting and analysing data in order to obtain the desired information with adequate precision (Struwig et al., 2001). The four purposes of this chapter are to (1) describe the research methodology of this study, (2) explain the sample selection, (3) describe the procedure used in designing the instrument and collecting the data, and (4) provide an explanation of the statistical procedures used to analyse the data.

3.1 Empirical Research

Empirical research can be highly useful in theory building and verification (Flynn et al., 1990). Empirical means “knowledge based on real world observations or experiment” and it is used in this study to describe field based research in which data is collected from natural situation. Empirical research can give consistent insights into different research issues. The most competent method of conducting a research is to pursue a systematic and proven approach. The study has followed the approach given by (Flynn et al., 1990). Simplicity and its systematic nature made it easy to follow and conduct empirical research. It consists of six steps/stages as depicted in fig 3-1.

Empirical research can be done either for theory building or theory verification. The basis of theory building is a professed problem, frameworks or assumptions or tentative hypotheses. The data is used to build theories. Theory building is an interpretative exercise designed to produce a theory which is tested later on. In theory verification hypotheses are generated in advance of the study and are tested by the data collected. The focus is on testing the hypotheses within the confidence levels. Theory verification can also be conducted through the collection of empirical data and subsequent mathematical / simulation modelling research be applied to refine or explore the causal relationships.

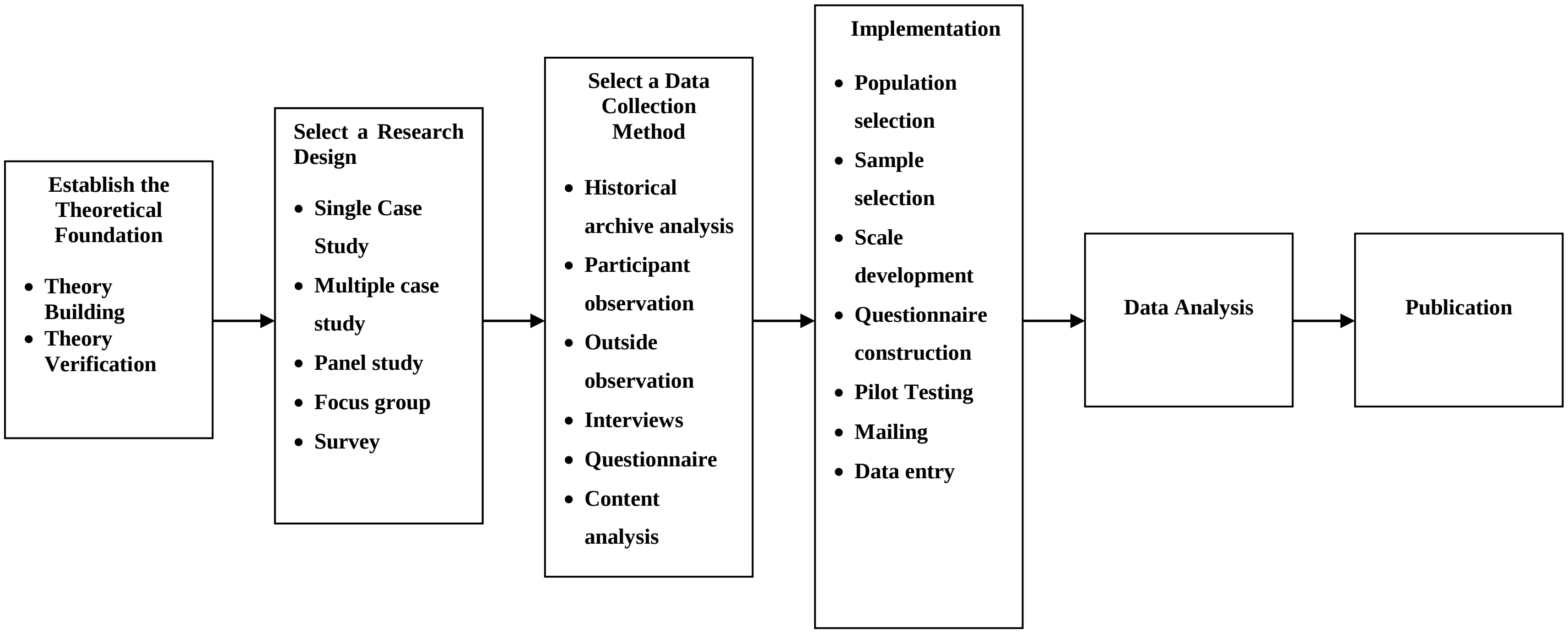


Figure 3-1: A Systematic Approach for Empirical Research (Flynn, et al., 1990)

Although survey is probably the most frequently used while selecting a research design, the other designs like single or multiple case studies, field experiment, panel study and focus group are also used. Surveys rely on opinion and self-report of factual data. It is also more cost effective with the capability to cover larger number of respondents.

Data collection can be done using any of the methods alone or in triangulation like Historical Archive Analysis, Observations, Interviews and Questionnaire. Questionnaire though is mostly used in survey research but it can be utilized in case studies, panels and focus groups too. One needs to pay appropriate attention in construction and administration of questionnaire to maximize its reliability and validity. It is developed mainly to test the theory hence theory needs to be carefully explained by literature review. In the next stage the implementation of the selected data collection method is described. The first step is the selection of the population and it depends upon the research question and hypotheses. The sample should be drawn randomly, once the master set of names has been obtained to control against the bias. Though one can choose any or mix of sampling methods depending upon the purpose and design of the research. The next step is development of scale. The most widely used is the Likert scale. One should try to get interval and ratio data as they enable researcher to use host of analytical techniques for analysis. After scale development questionnaire is constructed and is pilot tested before sending it to the selected sample. Pilot test helps to determine if there is any difference between the ways the respondents view the specific measures versus the researcher. The questionnaire is revised to ensure its user friendliness and validity & reliability of the measure. The survey is sent to large randomly selected sample. If possible non respondents can be contacted again using different means like site visits, email, telephone etc. The last step in implementation is data entry. Data entry should be done carefully to maintain the integrity of data. One needs to look for incomplete, blank or inappropriate responses along with handwritten comments. The next step of the systematic approach is data analysis. Several statistical techniques have been described in literature for analysis of data. Preparation of research report for publication is the last step.

3.2 Research Methodology of the Empirical Research

The methodology adopted for the study is discussed in following sections:

3.2.1 Theory Verification

At the beginning of research the theoretical foundation was identified for the research on Lean in Indian Services. Through literature review the concept of lean management and lean in services was studied. The status of Indian industry was also studied in depth with respect to need for process improvement and lean management. From the identified research gaps, objectives of the research were drawn. Identified 18 frameworks in lean services were studied in details to identify the various initiatives taken in this regard. As suggested by Flynn et al. (1990), the reliability and validity of these existing Lean services frameworks was conducted in Indian Services through cross sectional survey. The need for a lean service framework was identified. Subsequently, a framework for lean services was proposed along with the impact of lean practices on operational and business performance. The proposed framework was validated using cross sectional survey in selected Indian Services. The framework was further validated by applying the same in two case organizations.

3.2.2 Selecting the Research Design

Selecting the method and design of research is one of the most important factors in any research. The research design depends upon the data required, status of the industry to be observed along with cost and time factors. There are five main types of research designs experimental, longitudinal, cross sectional, case study and comparative (Bryman, 2004). An experimental research can be carried out in laboratory settings or in field settings. In longitudinal studies one focuses on a small group or organizations and examines them over a period of time. Cross sectional research entails collection of data from different organizations/sectors at single point of time in order to collect a body of quantifiable data which are then analysed to detect pattern of association. A case study consists of detailed and thorough study and analysis of the case in question. Comparative design involves a study using more or less the same methods of two distinct cases.

As our study entails to study the implementation of lean in Indian services cross sectional survey was preferred. Secondly the limitation of cost and time also required us to go for cross sectional survey. The survey is without a doubt the most preferred method as it helps to get opinion as well as facts or self-reports about the industry (Flynn et al., 1990). Empirical research i.e. gathering data from real world or naturally occurring situations; has been used to collect data across different service sectors in Indian scenario.

3.2.3 Data Collection Method

Survey questionnaire was used to collect the data. Both the questionnaires were administered using emails and personal visits. Emailing the survey enables the far and wide reach of survey along with giving flexibility to the respondent to fill the survey as per their time suitability. In the first case survey monkey and in second case Google docs were used to launch the survey. The questionnaire was prepared separately for the two surveys. The first questionnaire was to investigate the reliability and validity of existing lean service frameworks. The second was done to empirically investigate the proposed framework.

3.2.4 Implementation

To reduce the subjectivity of the respondents, lean/quality practitioners were chosen as the sampling framework. As no such directory exists hence www.linkedin.com was used to create the database for sample. On LinkedIn website search was done using key term "Lean" within the chosen service sector (Healthcare or IT/ITES or Financial Services or Banking or Telecom). Request for connection was sent to the people thus selected having experience in Lean in services. The database was created of the people who accepted the request for connection. Next, to select the sample service industries a brief literature review was done and it was found that from Indian perspective, the major service sectors are Banking/Financial, Healthcare, IT/ITES and Telecom (Talib et al., 2013). The reasons for choosing these four sectors are their high GDP share in Indian economy (about 25 percent) (IBEF, 2016); highly labour intensive industries and providing substantial employment (GOI, 2013). Similar approach was adopted by Talib et al. (2013) while studying TQM in Indian Services. The researcher also looked at what was being done by different service sectors as certain foundation of quality is necessary before embarking on lean journey. Domestic demand for services such as telecommunications and financial services along with exports of ICT and medical tourism in health care have contributed to the high growth of the services (Antony & Desai, 2009).These sectors also have a formal quality department and working earnestly towards process improvement techniques for being competitive in global market. Hence the questionnaires were sent to lean/quality practitioners in the chosen sectors working at top and middle management level. The relevance, importance and brief overview of each of the above four sectors are discussed below in section 3.2.4.1.

Along with the chosen service sectors the questionnaire was also floated to lean experts (academics and consultants; working in selected service sectors) considering lean is at nascent stage in Indian services. Secondly, experts can give insights into best practices across sectors and functions as they serve multiple clients across different sectors facing similar problems. Consultants also acts like trend-setters who create new frames of reference that forces top managers to recognize new methodologies to be adopted as a solution or for sustaining in the market.

3.2.4.1 Data Collection

As stated earlier scale development was done as the next step in implementation. Likert scale was used. The survey research was conducted in the third quarter of 2014 and in the second half of 2015. The details of the same will be provided in following chapters: four and six. In the first stage the survey link was emailed to 423 respondents and data was collected using survey monkey and to 1214 in the second stage using Google docs. The data was received in excel sheets as part of survey monkey and Google docs application.

3.2.5 Data Analysis

The collected data has to be analyzed to obtain meaningful and relevant information. Data Analysis is the procedure of systematically applying statistical and logical techniques to inspect, clean, describe, illustrate, transform and evaluate data. It leads to discovering of useful information, suggesting conclusion and aiding decision making. Statistical evidence helps in drawing conclusion and generalizing them. The Statistical Package of Social Science (SPSS) version 20 was used to analyze the data. The software is user friendly providing complete range of statistical methods along with simple methods of editing and labelling. The produced output is easily comprehensible and can be exported in different formats. Various data analysis techniques like descriptive statistics, correlation analysis, factor analysis, regression analysis etc. were used.

3.3 Brief Overview of Selected Service Sectors

3.3.1 Banking and Financial Services

The sector includes commercial banks, insurance companies, non-banking financial companies, co-operatives, pension funds, mutual funds and other smaller financial entities. The financial services sector contributes nearly 6 per cent share in country gross domestic product (GDP) in 2014-15 thus making it an important contributor. The highlights of Indian Banking and Financial services are:

- India's banking sector has remained stable despite global mayhem, thus preserving the confidence of public over the years.
- Private and foreign banks have posted high return on assets than nationalised and public banks; which has prompted many of the foreign banks to start their operations in India.
- Around 44% people uses Net banking, thus it is the most favourite mode of payment among internet users in India.
- The asset management industry in India is among the fastest growing in the world.
- India's life insurance sector is the biggest in the world with about 360 million policies.

Total Indian banking sector assets has reached USD1.96 trillion in FY15 from USD1.3 trillion in FY10, with over 70 per cent accounted by the public sector. Deposits have grown at Compound Annual Growth Rate (CAGR) of 11.2 per cent during FY06–16 and have reached 1.43 trillion in FY16 (IBEF-Bank, 2015). Continued infrastructure investment have helped in growth of the corporate demand for bank loans along with the other policy decisions such as reducing oil subsidies, issuing of telecom spectrum licenses and the proposed abolition of penalty on loan prepayment. The ease and far reach of online banking has led to use of net banking instead of traditional branch banking.

Total AUM (Assets Under Management) of the mutual fund industry clocked a CAGR of 12.8 per cent over FY07–16 (Till September 2015) to reach USD215.4 billion (IBEF-Fin, 2015). India has fourth largest ultra-high net worth households in the world according to BCG report entitled “Global Wealth 2015: Winning the Growth Game. Considering that a HNWI does a minimum investment of 10–20 per cent, the size of the wealth management industry by the end of 2015 was around USD50–60 billion. Around 46 per cent of household savings are invested in bank deposits and 53.6 per cent in other financial asset classes. Innovative and customised products are expected to shift bank deposits to these asset classes.

India’s life insurance sector is expected to increase at a CAGR of 12-15 per cent over the next five years. Insurers grew at the rate of 8.5 per cent in FY15, with private premiums rising at 10.5 per cent and public premiums at 6.9 per cent in comparison to FY14. Companies in the sector are coming up with customised products in order to serve the client needs in better way.

A fast growing economy, rising income levels and improving life expectancy rates are some of the many favourable factors that will enhance the growth in this sector in the coming years. The outburst in number of mobile phones, proliferation of social media sites, insurgence of technologies such as cloud computing and rising pace of interconnectivity have led companies to boost up their investment in Information Technology (IT) to better serve their customers. Banking operations had been made easier and user friendly by addition of internet banking and core banking. As per Gartner Inc, the insurance sector is estimated to spend about USD2.2 billion on IT products and services in 2015, up 10.4 per cent from 2014. Expenditure on technology is expected to increase at an annual rate of 14.2 per cent. Rise in incomes in rural areas are expected to enhance the need for banking services and compelling the growth of the sector. The growth of mobile banking will also impact this sector significantly .India is said to be having highest number of working population (in 15-64 age group) which is expected to grow further , giving further push to the number of customers in banking sector.

3.3.2 Health Care

The healthcare sector is one of the fastest growing industries. It is expected to grow at a CAGR of 17 per cent during 2011–20 to reach USD280 billion. Awareness for health, change in attitude towards preventive healthcare, rise in income levels and ageing population has augmented the demand for healthcare services. The salient features below have made India a leading player in global healthcare market:

- India is expected to rank amongst the top three healthcare markets in terms of incremental growth by 2020.
- India was the sixth largest market globally in terms of size in 2014.
- Patients from across the world have been attracted due to low cost medical services making Indian a major hub for medical tourism. It is a $1 billion business that is growing by 30% a year (Govindarajan & Ramamurti, 2013).
- There are 27 Joint Commission International (JCI) and 453 National Accredited Board of Hospitals (NABH) - accredited hospitals in India and growing.
- India has also emerged as a focal point for R&D activities for international players due to its relatively low cost of clinical research.

The total industry size is expected to touch USD160 billion by 2017 and USD280 billion by 2020 (IBEF-Healthcare, 2015). 100 per cent FDI, permitted since January 2000, under the automatic route for the hospitals sector in India has been a major factor for growth of the sector in last decade. In 12th five year plan the share of healthcare has increased to 2.5 per cent of GDP from 0.9 per cent in the 11th Plan (IBEF-Healthcare, 2015). The sector is braced to grow to USD280 billion by 2020 due to large investments by private sector players leading to the development of India's hospital industry.

Telemedicine is a fast-emerging sector in India. Many of the hospitals like Apollo, AIIMS, Narayana Hrudayalaya etc. have adopted telemedicine services and entered into a number of PPPs (Public Private Partnerships).Telemedicine can bridge the rural-urban split in terms of medical facilities, extending low-cost consultation and diagnosis facilities to the remotest of areas via high-speed internet and telecommunication. It is expected to rise at a CAGR of 20 per cent, to USD18.7 million by 2017 from USD7.5 million in 2012.

World-class hospitals with up to date diagnostic facilities, skilled medical professionals coupled with low treatment costs in comparison to other countries is benefiting Indian medical tourism which has, in turn, enhanced the prospects of the Indian healthcare market Treatment for major surgeries in India costs approximately 20 per cent of that in developed countries. Private players in the sector are working to build efficient supply chain and leveraging economies of scale to reduce cost (Govindarajan & Ramamurti, 2013). They account for almost 72% of the country's total healthcare expenditure. Players in the sector are providing multiple health care services under one roof and better services to differentiate themselves. At present, about 50 per cent of spending on in-patient beds is for lifestyle diseases because of increasing urbanisations and problems associated with modern day living. Moreover, changing demographics will also add to higher healthcare spending and demand for specialised care; as the size of the elderly population set to rise from the current 96 million to about 168 million by 2026. This has augmented the demand for specialised care. Tier II and tier III cities are also having extensive demand for high quality services in healthcare.

The technological aspects of healthcare delivery has become a focal point for healthcare providers as it helps in controlling cost, enhancing patient engagement and standardising the quality of service delivery. Some of the technologies like Digital Health Knowledge Resources, Electronic Medical Record, Mobile Healthcare, Electronic Health Record and Hospital Information System are gaining wide acceptance in the sector.

Government is encouraging the PPP model to improve availability of healthcare services and provide healthcare financing. Establishment of system of Universal Health Coverage (UHC) in the country will enable assured access to a defined essential range of medicines and treatment at an affordable price, which should be entirely free for a large percentage of the population. Scope of Rashtriya Swasthya Bima Yojana (RSBY) has been enhanced to include the weaker section of the society rickshaw pullers, taxi drivers, sanitation workers, rag pickers and mine workers. Creation of new National Health Mission (NHM) for providing effective healthcare to both urban and rural population, with stress more on states with weak health infrastructure and indicators

3.3.3 Information Technology / Information Technology Enabled Services

The IT-BPM sector in India expanded at a CAGR of 25 per cent over 2000–13, which is 3–4 times higher than the global Information Technology – Business Process Management (IT-BPM) spend, and is estimated to expand at a CAGR of 9.5 per cent to USD300 billion by 2020. The highlights of the sector which has made it most lucrative for Indian services are:

- India is the world's largest sourcing destination, accounting for approximately 52 per cent of the USD124–130 billion market.
- India's IT industry amounts to 12.3 per cent of the global market.
- The country's cost competitiveness in providing IT services, which is approximately 3-4 times cheaper than the US continues to be its USP in the global sourcing market.
- India's highly qualified talent pool of technical graduates is one of the largest in the world, facilitating its emergence as a preferred destination for outsourcing.
- The contribution of the IT sector to India's GDP rose to approximately 9.5 per cent in FY15 from 1.2 per cent in FY98.
- The sector ranks fourth in India's total FDI share and accounts for approximately 37 per cent of total Private Equity and Venture investments in the country.
- Around 80 per cent of revenue comes from exports.
- The top six firms contribute around 36 per cent to the total industry revenue, indicating the market is fairly competitive.

Total exports from the IT-BPM sector (excluding hardware) were estimated to have been USD76 billion during FY13; exports rose at a CAGR of 13.1 per cent during FY08–13 (IBEF-IT/ITES, 2015). Export of IT services has accounted for 57.9 per cent of total IT exports (excluding hardware) .BPM accounted for 23.5 per cent of total IT exports during FY13.Traditionally US has been the biggest importer of Indian IT exports; absorbing over 60 per cent of Indian IT-BPM exports during FY13 .While, non US-UK countries accounted for just 21.0 per cent of it. Around 85 per cent of total IT-BPM exports are largely from four sectors: BFSI, telecom, manufacturing and retail. Banking, Financial services and Insurance (BFSI) sector accounts for 41.0 per cent of total IT-BPM exports from India in FY13. Thus it is a key business vertical for the IT-BPM industry. Having the advantage of being the low cost exporter of IT services, India is going to be a focus for more markets in other regions too. Europe is likely to come out as a budding market as it has emerged as one of the fast growing IT markets in 2012. As per a customer poll conducted by Booz and Co, India is the most favoured destination for engineering off shoring. Companies are now off shoring complete product responsibility. Large players with an extensive gamut of offerings are gaining ground as they move from being simple maintenance providers to full service players, offering services in various fields like infrastructure, system integration and consulting .About 80 per cent of the total revenue is contributed by 200 large and medium players.

The other sectors like education, healthcare and retail, with introduction of new policies are likely to grow at a faster pace in coming years, thus spurting the revenue of IT enabled services for these sectors. Advent of large e-Governance projects to offer better services through IT and focus on the generation of the cyber policy led to larger demand for IT and hardware from the government. Emergence of SMAC (social, mobility, analytics, cloud) will make available USD1 trillion market by 2020. Cheap labour, reasonably priced real estate, favourable government regulations, tax breaks and SEZ schemes have facilitated the rise of tier II and III cities as a new IT destination. Companies are now investing a lot in R&D and training employees to create an efficient workforce, enhancing productivity and quality. Increased focus on R&D by IT firms in India resulted in rising number of patents from 150 in 2009 to 858 in 2012.

Rise in computer literate population, increased internet and mobile penetration, advent of Smartphone, tablets, iPads and growing disposable income strengthening consumer purchasing power will further boost up the demand of IT/ITES. Technologies, such as telemedicine, health, remote monitoring solutions and clinical information systems, would continue to enhance demand for IT service across the globe.

3.3.4 Telecom

India has a strong telecommunication infrastructure. India ranks ahead of its peers in the West and Asia in terms of telecommunication ratings. Indian telecom sector's revenue grew 13.4 per cent to USD64.1 billion in FY12

The salient features of this sector are:

- India has the second-largest telecom network in the world with a subscriber base of nearly 964 million by the end of November 2014.
- India is third-highest in terms of total internet users, with 164.81 million internet subscriptions in 2013.
- Seven out of eight users access Internet from their mobile phones
- The top five players account for over 79 per cent of the total subscribers.

In November 2014, total telephone subscription stood at 964 million, while teledensity was at 77.2. Urban teledensity was at 147.38 per cent and rural teledensity at 45.76 per cent as of November 2014, up from 87.1 per cent and 23 per cent, respectively, in March 2000. The mobile segment’s teledensity jumped 5 times to 74.95 per cent in November 2014 from 14.6 per cent in FY07. India to have 519 million mobile internet users by 2018, according to a Morgan Stanley survey (Huberty, 2011)

The government has been proactive in its efforts to transform India into a global telecommunication centre; far-sighted regulatory support (TRAI) has also helped. TRAI has come up with several recommendations for the development of telecom infrastructure, including tax benefits and recognising telecom infrastructure as essential infrastructure .A surge in the subscriber base has necessitated network expansion covering a wider area, thereby creating a need for significant investment in telecom infrastructure. National Telecom Policy 2012 proposes unified licensing, full MNP and free roaming. FDI cap has been increased to 100 per cent from 74 per cent. The government has also revised the M&A guidelines in 2013 and has raised the limit on the market share of a merged entity in a circle to 50 per cent from 35 per cent earlier (IBEF-Telecom, 2015). Companies are allowed to trade spectrum and they pay for spectrum beyond a prescribed limit if it was acquired after paying the entry fee and not through auction. There are over 62,443 uncovered villages in India; these would be provided with village telephone facility with subsidy support from the Government’s Universal Service Obligation (GUSO) Fund.

The green telecom concept is aimed at reducing carbon footprint of the telecom industry through lower energy consumption. The most significant recent developments in wireless communication include BWA technologies such as WiMAX and LTE. WiMAX is expected to have attracted around 8 to 10 million subscribers. To enhance local research and manufacturing of telecom products, the government has come up with a planning of investment of USD32.2 billion in three phases: i) USD9.2 billion to the Telecom Research and Development Fund, ii) USD4.6 billion for the Telecom Entrepreneurship Promotion Fund, and iii) USD18.4 billion to the Telecom Manufacturing Promotion Fund during the 12th Five-Year Plan.

Increasing income level has been a key determinant of growing demand in the mobile and internet segments. A young, growing population is aiding this trend (especially demand for smart phones) .Availability of affordable Smartphone, along with a rise in the security level of mobile transactions has heightened the growth of transactions conducted via phones, with the overall transaction value being tripled in 2014 from last year

Customers' low switching cost and price sensitivity have increased competition among players. Players are using innovative marketing strategies and services to thrive in this sector. They price their products very carefully due to the price sensitive nature of customers and high competition in the sector. The share of non-voice revenues will rise to more than 30 percent from the current level of 10 percent in the next five to seven years. A decline in the prices of smart phones and data subscription rates is likely to drive demand for Mobile value added services. Telecom companies have been dissociating their tower assets into separate companies to control costs and focus on core operations. It has helped telecom companies to lower their operating cost and improve capital structure thus providing an additional revenue stream also. Taking on inspiration from this globally operators are now replicating this model.

3.4 Conclusion

The chapter summarized the approach followed for conducting empirical research for the cross sectional survey. The systematic research methodology adopted was explained step by step. The approach adopted to accomplish the research plan was explained in detail. The chapter also has a brief overview of the various sectors to which the questionnaire was sent.

CHAPTER 4: RELIABILITY AND VALIDITY OF EXISTING LEAN SERVICE FRAMEWORKS IN INDIAN SERVICE INDUSTRY

4.1 Introduction

Many Indian service organisations especially in financial, health care, IT/ITES and telecom are working to improve their quality for customer satisfaction, operational excellence and survival in turbulent environment. As an endeavour many have adopted lean practices though most of them are doing just as process improvement or in silo fashion. Need of the hour is a comprehensive guide map/framework catering to Indian scenario for achieving long term gain of lean practices in services. The systematic literature review in chapter 2 revealed 18 lean service frameworks. In the next section, a detailed description about the existing frameworks is presented[2].

Table 4-1: Taxonomy of Lean Services Framework

Taxonomy	Author	Industry
Design / Conceptual	Comm & Mathaisel (2003)	Education
	Ahlstrom (2004)	Services
	Apte & Goh (2004)	Information Intensive
	Sa´nchez & Pe´rez (2004)	Services
	Kollberg et al. (2007)	Health Care
	Sarkar (2007)	Service
	Radnor (2010)	Public Sector
	Dahlgaard et al. (2011)	Health Care
	Kundu & Manohar(2012)	IT
	Malmbrandt & Ahlstrom (2013)	Services
Implementation	Cuatrecasas (2002)	Telecom
	Bonaccorsi et al., (2011)	Services
	Bonneau (2011)	Consulting
	Kuusela & Koivuluoma (2011)	IT
	Kreuzer et al. (2011)	Services
	TCS (2011)	Telecom
	Guimarães & de Carvalho (2012)	Service
	Damrath (2012)	Health Care

[2] Part of this chapter is accepted and is under publication in International Journal of Lean Six Sigma.

4.2 Existing Lean Service Frameworks

4.2.1 Design/Conceptual Framework

1. **Comm & Mathaisel (2003):** The authors based on review of lean principles, practices and site visits to firms in the USA possessing best practices for long-term sustainment established how a lean sustainability initiative could be developed and implemented by colleges and universities. The authors in their framework used the lean overarching practices and their enabling best practices as described by Nightingale (1999) with a specific example cited for a college or university. The authors believed that the changes demanded in universities and colleges from various stakeholders can be driven by advances in technology and can be implemented using the lean overarching principles in partnership with industries.

   The authors asserted that the lean practices should be able to reduce university's operating costs leading to improvement in volume and quality of output and increasing profits which will help them sustain their position in an increasingly competitive environment. They identified requirement for better coordination and integration between the administrative and the academic sides as one of the major barrier for establishing the lean framework for a sustainable university. The successful implementation depends a lot on management commitment towards cultural change and advanced planning. The main elements of the framework are given in table 4-2.

2. **Ahlstrom (2004):** The starting point is the framework presented by (Womack et al., 1990). It was synthesised and further developed by Karlsson (1992) which has been translated into service companies by the author, using an empirical base consisting of descriptions of lean production applications in the service sector, made by practitioners in service companies. By translations the author means necessary interpretations and changes while adopting the principles from manufacturing to services. The author delivered the lean production concept at the executive seminar. Participants in groups of five to seven people had the task of translating lean production's principles into service operations. Out of the ten descriptions made in

the seminar the author has chosen four descriptions which were more complete and satisfy the constraint of space.

The author concluded that lean management is applicable to services but this adoption has certain contingencies due to nature of service especially due to customer involvement as a co-producer of the services. In some instances it is more applicable to services again due to inherent characteristics of services. Thus lean production principles can be taken as a conceptual guide for improvement of services. Author also stressed on the importance of technology to eliminate waste and of information for continuous flow. The definition of waste has to be seen from each operations perspective as services are mixture of experience and outcome. The customer also brings expectations of the service delivery into the transaction thus zero defects are difficult to achieve as expectation varies. The principle of pulling material if and when it is needed is easily applicable to the materials used in services but difficult to employ beyond materials. Though in certain services like health care pure pull based system is not feasible. Role of competence of service providers are more important than in manufacturing, hence need of multifunctional teams. Employees too need to have authority for fast decision making.

As the line of demarcation between manufacturing and services blurs the author has emphasised on focusing on similarities between services and manufacturing and generalising the operations. The main elements of the framework are given in table 4-2.

3. **Apte & Goh (2004):** Authors using example of insurance claims handling process have exemplified how the lean manufacturing principles can be beneficially applied, though with some modifications, to information intensive services. The framework has been illustrated around five principles which are: (a) identifying, enhancing, and implementing value added activities to improve outcome of service provided, (b) effective management of supplier relations and information flow, (c) elimination of waste, (d) appropriate matching of service capacity to customer-driven demand, and (e) continuous improvement (kaizen).

The authors have emphasised on developing a widespread and comprehensive set of metrics that allows for regular monitoring of the operational performance by the management. They advocated that the productivity measures be used in conjunction with the quality measures since both are intrinsically intertwined in services. Service request are similar to WIP but are hidden in services in background as in computer files. The authors suggested for minimizing cycle time so as to control hidden service requests, as cycle time plays the same role as reducing inventory in manufacturing. Since today's customers are demanding better and faster service from the service providers cycle time has become a very important performance metric in services. Authors advocated use of metrics such as cycle time, customer satisfaction and labour utilization rates as measure of performance. The main elements of the framework are given in table 4-2.

4. **Sa´nchez & Pe´rez (2004):** The authors in their framework give lean indicators for operations management in service companies with an aim to be useful for services operations. The authors have validated the use and importance of the framework in a sample of services companies. The framework proposes six groups of lean indicators following the model proposed by Karlsson & Ahlstorm (1996). The authors have assumed that all practices cannot be implemented simultaneously but will be done in step by step fashion. Authors have recommended use of comprehensive checklist to assess changes towards lean operations. The framework will satisfy the need to assess leanness achieved as a result of lean practices being adopted.

   The framework has emphasized more on lean performance indicators. The indicators have been kept to minimum with the aim of having simple and easy to use framework so it can be implemented even by small and medium companies. Each production indicator has been related to at least one operation indicator. Authors have stressed on the importance of involvement of all employees and the support of top management for successful lean implementation. They also advocated on the supplier's involvement in services design as a way to reduce development times, and therefore to reduce costs and gain competitive advantage in the market. The survey for empirically testing the framework showed that larger companies use more of the indicators and give them more importance too. It also showed that quality and flexibility were the most influential operation objectives for the use of lean indicators. The main elements of the framework are given in table 4-2.

5. **Kollberg, et al. (2007):** The authors designed the flow model to measure changes towards lean thinking in health care services by identifying the key performance indicators. The authors have based their model on Womack & Jones's (2003) five lean principles of specify value, identify value stream, flow, pull and perfection. The model makes it possible to trace the path an individual patient follows through the health care system by focusing on eight measures which are accessibility, quality of medical care, delays, preparation time, referral management, booking routines, JIT, and process control. Flow model measures waiting time as it indicates achievement of lean principles of flow and pull. It has been found that the flow model do not covers important measures like policy deployment, comfort, treatment, respect and participation, and continuous improvement. The flow model is not sufficient in itself and needs to be supported with other measurements in order to give the comprehensive picture of lean performance.

   The authors talks about how the flow model may help the healthcare organisations to develop measurements of lean thinking initiatives on existing care processe thus playing an important role in managing and improving health care processes. A new way of thinking regarding managing health care is needed for implementing a performance measurement system. A larger shift in management is required to efficiently plan for changes in mindset and work. The main elements of the framework are given in table 4-2.

6. **Sarkar (2007):** Author believes lean to be a holistic approach leading to improvement in process efficiency, quality, quicker delivery of services and savings in cost. To achieve it he created Deb's Lean organisational excellence model (DEB – LOREX) of lean transformation. The model helps to change the mindset of employees and work towards improving capabilities and building cultures that supports problem solving, continual improvement and excellence. The model has been developed as an amalgamation of two philosophies of lean thinking and system thinking. Implementing lean thinking as a system helps to understand the causes, how they impact the various processes and the results (Sarkar, 2007). As the author

states this is what is missing in service organisations. The system thinking also helps to identify and establish inter relationships within the sub systems. This ensures that improvement in one area doesn't impact the other negatively. For sustained benefits it is vital that all the lean elements function in harmony to deliver the desired results.

Any organisation adopting the model needs to adopt lean management as a business strategy with the commitment from top management. It emphasised on looking at processes from end to end perspective thus moving beyond functional silos. Employee are highly engaged and involved in lean implementation. Metrics of lean management system is tied to the performance appraisal. Non-financial and financial parameters are taken into account while measuring process performance. Suppliers and outsourced agencies are treated as partners. The main emphasis is on problem prevention mind set. The main elements of the framework are given in table 4-2.

7. **Radnor (2010):** The author talks about the transfer of lean approaches to a UK government department. By visiting ten sites the author tries to understand which tools are relevant and have had an impact. Based on these findings the author has suggested two frameworks– the first one clarify the purpose of the lean tools in terms of assessment, improvement and monitoring. The second depicted as, the House of Lean, as a framework talks not only about the tools but also the factors which supports the implementation of the tools. Building on the concept of Hines & Lethbridge (2008) the author had built strong foundation of a number of factors which ensure that the organisation is ready to engage with, or can enable, Lean. The tools of lean management are built on this foundation as pillars of house. The foundation factors are also called readiness factors and are the key elements in supporting the lean tools. These factors stresses on understanding value, demand and capacity, having process view supported by strong leadership and communication strategy. These factors are supported by bedrock of training & development and steering committee or project group. In this framework, the tools are to engage, establish and embed Lean leading to both technical and also cultural change leading to a structured dynamic learning environment.

The findings of the case studies revealed that the tools mainly focused on reduction of waste and some of the concepts like standardisation are not applicable to public services. The key in applying lean to public sector is a greater understanding of differences between manufacturing and public sectors are and how lean practices and principles can be adapted to the public sector. The questions still remain is whether the lean practices tools of manufacturing are enough or services should make some of their own. The main elements of the framework are given in table 4-2.

8. **Dahlgaard, et al. (2011):** The authors have developed a framework/system based on " 4P excellence model" for assessing and improving the health organisation. The system has three components (1) a framework or model for assessing, measuring, diagnosing and improving healthcare organisations, (2) a simple methodology for data collection, data analysis and prioritising improvement areas and (3) an index named ILL (innovativeness, learning and lean) which measures the level of excellence and the potentials to increase that level.

   The authors have emphasised on stable organisation culture on which to build. The "4P Excellence Model" is about achieving excellence or quality in 4Ps which are (1) people (2) partnership/teams (3) processes of work and (4) products/service products to achieve operational excellence. They advocated for the strategy to build quality in people which will lead to building of quality or excellence in other three P. The authors believed that quality improvements and waste reduction require a systematic and well-planned process with people involvement. The model has been supplemented with a framework for identifying and measuring potential KPIs. A self-assessment survey was developed to assess the level of excellence and areas for improvement. The main elements of the framework are given in table 4-2.

9. **Kundu & Manohar (2012) :** The authors have presented a unified model by combining lean and CMMI-SVC (Capability Maturity Model Integration for Services) best practices which will be useful for CMMI Service organizations that plan to implement Lean. In the model the lean practices have been plugged into CMMI- SVC to align the improvement initiatives with business objectives. Authors believed that unification of both lean and CMMI-SVC v1.3 best practices will complement each other enhancing the service effectiveness and efficiency. The

framework was validated by group of practitioners and experts having theoretical and practical expertise on the CMMI framework, software process improvements as well as lean principles and services. Questionnaire based face-to-face semi-structured interviews were conducted followed by focus group discussion on the proposed unified model so as to arrive at a consensus.

The new model retained the twelve old processes of CMMI-SVC model where lean specific goals and practices have been included. It has introduced the three new processes: process management, project & work management and service establishment & delivery, support. Authors stressed on importance of senior management involvement and team building for successful software process improvement. The new areas placed emphasis on organisational value & culture, knowledge management and technology management. Lean specific practices of supplier as a partner, visual control, workload balancing and continuous practices have been also incorporated in various existing process areas. The model will help the organisations which want to implement lean management and have already implemented and are familiar with CMMI practices. It will also help the organisations which want to implement both practices simultaneously. The main elements of the framework are given in table 4-2.

10. **Malmbrandt & Ahlstrom (2013):** The authors have developed and qualitatively validated a self-assessment instrument having operational measures of lean service to be used both by practitioners and researchers. Practitioners may use the instrument to track the progress during lean service implementation and highlighting the deviations from plans. Empirical validation was done by conducting workshops and semi-structured interviews with expert practitioners. They also tested the instrument's ability to distinguish between high and low adoption of lean. Lean adoption enablers, practices, and operational performance were assessed using 34 items. These items are measured on maturity levels adopted similarly by Nightingale & Mize (2002) in their LESAT (LAI Enterprise Self-Assessment tool). Enablers act as a supporting structure to lean. Lean practices are those which lead to methodological process improvement. Discussion with practitioners showed that performance measure of lead time, inventory, productivity and quality are not enough as depicted in literature. Hence authors added cost and customer satisfaction as per the suggestions of practitioners

and experts. Maturity levels give the picture of progression made of lean implementation. Authors advocates the importance of assessing the use of lean practices against the background of the fact that lean adoption is a long and complex process and that some performance items may even show decline initially as also pointed out by Karlsson & Ahlstorm (1996).

The instrument was validated in four ways. As the interest of adopting lean in services is increasing rapidly there is a need to understand lean as a philosophy and not just as mere tools and practices. An assessment tool is needed to gauge the progress made which is not possible alone with financial measures. As lean is dynamic in nature continuously evolving, hence with time the instrument needs to be iterative with addition, deletion and modifications of items over time. Heterogeneous natures of services have to be also kept in mind and certain items may be redefined as per the characteristics of the service organisation. The main elements of the framework are given in table 4-2.

4.2.2 Implementation Framework

1. **Cuatrecasas (2002):** Author has given a methodology for implementation of lean management in a services production system, as applied to the case of telecommunication services. Author believed that services have higher variation than in manufacturing and thus have thus included an analysis of that variability in the model and a proposal for action to be taken when it is excessive. The objective of the framework is to have an ordered proposal for management measures which helps the organisation to move from a conventional approach to one of lean improvement and to establish the level of improvement thus achieved. The model has been validated by its application in a telecom organisation. The author believed that difficulty in standardisation and variability are the two major limitations in services for implementation of lean management which are handled in this model.

   Author has advocated for horizontal and flat structure along with participative culture for successful adoption of lean management. He has advocated for adjusting tasks to workstations to the greatest extent possible with the endeavour of eliminating waste, balancing workstations to achieve efficiency, cost and time competitiveness characteristics of lean. The main elements of the framework are given in table 4-2.

2. **Bonaccorsi et al., (2011):** Considereing the issues of lack of process visibility and ownership in services the authors has developed a comprehenisve lean approcah based on Value Stream Management (VSM) called as Service Value Stream Management (SVSM). The model has been validated in an enrollment center using the case study approach. To achieve same, some major adaptations were made like:
    a. For a detailed process map/ value stream map for services new process icons were created,
    b. Many of the lean approaches were modified and
    c. Concepts such as Takt-Time and Pitch have been redefined in a more suitable way.

    As an modification to lean theory of eight wastes the authors have illustrated the ten wastes of services as duplication, uncorrect inventory, lack of customer's focus, over production, unclear communication, motion/transportation, under utilised employees, variation and waiting/delay. The authors stresses on more efficent use of VSM in services to bring out clearly what is ought to be done, instead of relying more on tools like Kaizen and 5S. Authors views them as more suitable to manufacturing as they just lead to faster way to do things.SVSM was built on set of conceptual and generic principles of lean organized in a structured framework. SVSM follows a step by step procedure made of six steps as 1) commit to lean; 2) learn about lean; 3) choose the value stream to be improved; 4) map the current state; 5) identify the impact of waste and set the target for the improvement; 6) map the future state. It goes far beyond the potentiality of the standard VSM in that it has been specifically modified to tailor the needs of pure services. In SVSM presence of customer icon is an important element, allowing for visualisation all the steps requiring the physical presence of the customer, during the ongoing activities of the service. Material and data supplier's icons have also been added to better specify the nature of the first tier supplier(s). Similarly the inventory icon may have a different meaning in a service value stream, as it can represent materials, documents or both.

The authors held that lean mangement can be implemented in services leading to cost savings and increase in customer satisfaction. Though applying lean in services is a daunting task and lean approach has to be adapted as per the characteristics of services. The authors believed that given model SVSM is flexible in nature and can be applied to a wide range of different cases. Thus it can be used as a roadmap to develop a true lean service and can be tailored to the requirements of specific sectors. The main elements of the framework are given in table 4-2.

3. **Bonneau (2011):** The author has devloped the model so as to ascertaing how work efficiency of a consultant can be improved using lean along with how implementation of services differs from that in manufacturing. The framework was developed as part of study at Technology Transformation (TT) department of Capgemini Consulting, France. Author adopted the genchi genbutsu (go and see) approach to do this analysis. He advised the lean implementation in four different steps that Liker (2004) has identified in his 4P model (Philosophy, Processes, People and Problem solving).

   As the part of first step was evaluating the current work situation consultants, managers and director were interviewed to understand the consultant challenges and to understand the responsibilities of their jobs within the team. Data was collected from secondary sources like Capegemini home page, their intranet and knowledge management tool. The importance-performance matrix and the operation strategy matrix were used to analyse operational strategy. The performance was measured in metrics of quality, speed, dependability, flexibility and cost. Process technology and supply network were also studied to give insight into working of consultants. The next step was drawing VSM and identifying the wastes in the processes. The author suggested using various lean process improvement practices and tools like pull, levelled workload, 5S, Standardisation etc. They advocated treating people as partners and adopting PDCA as problem solving methodology for successful lean implementation. The author further stated that differences in manufacturing and services moderate the improvement opportunities of lean implementation. The main elements of the framework are given in table 4-2.

4. **Kuusela & Koivuluoma (2011):** Authors gave a lean framework for software companies on the idea that in order to succeed; software intensive enterprise's cloud transformation should have lean philosophy woven in. The framework tries to answer the two things: the steps to be taken for lean transformation and viewpoints to be considered while going for lean transformation. The framework is derived from framework given by Smeds (1994) and Womack & Jones (1996), mainly for manufacturing. As authors pointed transformation needs both strategy-oriented and operations-oriented approaches. It is driven by value deficiencies and involves evaluating and improving the work processes.

   The transformation lean framework is implemented on the perspectives of goal, approach, and the scope. The proposed lean transformation framework includes three cycles i.e. strategic alignment cycle, organisational and business alignment cycle and lean implementation cycle. In strategic alignment cycle lean thinking is intertwined with business strategy. In the second cycle the things related to business and organisational development shall be planned and deployed. Lean implementation represents shorter term activities and mainly focuses on continuous improvement at team or project level. The framework was tested by application of same in a software company. The main elements of the framework are given in table 4-2.

5. **Kreuzer et al., (2011):** The authors suggested a framework called Service Strategy Scorecard integrating lean service approach and service improvement methodology. It aims for handling improvement and innovation in services following a new holistic and systematic approach. Service Strategy Scorecard is based on balanced scorecard approach and it measures the service performance, the innovation strategy and interrelated dependencies between important service design dimensions.

   It is based on a stage gate concept, and uses organisation specific toolbox of methods and management tools. Between each stage, there is a quality control milestone and the selected service must pass before continuing to the next stage. As the framework incorporates the main service design aspects (service/product model, process model and resource model) it can also be seen as a Lean Service approach. The service (re)engineering methodology can be used as a useful tool for implementing a systematic lean/continuous improvement cycle with an aim to improve existing services and to identify new innovate services in an organisation. The proposed procedure has especially been carried out from the practical aspect of a "Lean Service Engineering" in SMEs helping them to increase innovation, improve service quality and customer service. The main elements of the framework are given in table 4-2.

6. **TCS (2011):** The Telecom Lean Operations also called as O-PERA offered by Tata Consultancy Services (TCS) aims to bring in greater efficiency in operations of telecom services. The framework aims enhance the organization's overall financial performance and achieve the dexterity needed to succeed in a competitive market. The O-PERA assesses the organisation's lean operation maturity level and identifies the possible paybacks that can be achieved. Adopting it will lead to operational efficiency, optimization of processes, result optimization aligning IT with business leading to result optimization and assuring proper management and delivery of service.

   The framework supports optimization and continuous improvement resulting into low operational cost. The use of business KPIs and operational dashboards ensures that results are associated to organisational business objectives. The managed service model establishes a clear sense of ownership and transparency for the services provided. The main elements of the framework are given in table 4-2.

7. **Guimarães & de Carvalho (2012) :** The authors gave Lean assessment framework for healthcare organizations with an aim of helping them throughout a long journey. The framework is based on Shingo Prize (SP) (Shingo Prize, 2011) and presents Lean implementation as a journey through achieving different Lean maturity levels. The authors believed that what makes an organisation achieve superior level of implementation is not always the eagerness to improve but improvement process monitoring. Though there is a linkage between lean implementation and results of implementation but authors believed that both aspects should be treated differently in any assessment instrument. Most of assessment research focuses on outcomes only i.e how it impacts performances measuring impact on cost, quality and delivery.

   The framework has four levels of leanness matching the four stages.Each stage has both hard and soft dimensions of lean management. The soft dimensions include relational and emotional competences like willingness to change, lean values, trust building etc. Hard dimensions are the lean tools and techniques being practiced like training of tools, kaizen or RIE's, Value Stream, seamless flow etc. It can be used as an "as is" diagnosis tool, assessing whether each process needs to be improved or eliminated providing control measures and correction actions in a healthcare organisation. The main elements of the framework are given in table 4-2.

8. **Damrath (2012) :** The author gave a theoretical framework for applying lean in services using specific set of lean tools. The given framework can be tailored to individual service business and can be used as a general advice and as a guideline or an initial starting point for implementing a Lean culture in services. The successful lean implmentation requires strong commitment of leadership team, engagement & involvement of the line workers and a clear understanding of what your customer needs. A strong foundation for lean implementation needs to be established at a strategic level. Human Resource strategy including employee's responsibilities, rewards, and incentives needs to be aligned with lean transformation strategy.

   The framework consists of three phases each requiring different kind of Lean tools and practices, which mainly should be undertaken in order to attain a decent level of maturity before going on to the next phase. Along with lean tools for transforming the service organization for each phase the author suggests a managerial approach (MGMT) to be followed. The framework advocates using lean tools like VSM, Standardise processes, 5S, Heijunka Scheduling, Jidoka, Kaizen, Flow and dojo or quality circles in different phases of framework. The last phase is an ongoing activity. The authors also talks about challenges in applying lean in service organisation like; complexity and size of service processes, invisibility of service processes, service process quality depends on people involved, some service processes cannot be aligned with lean ideas. The author suggests that the framework should be taken as a roadmap only and it is not an encompassing recipe to implement Lean. The main elements of the framework are given in table 4-2.

Table 4-2: Elements of the existing lean service frameworks

Comm & Mathaisel (2003)

- Linear flow arrangement : Flexible Cells
- Small production batches: a single unit
- Rapid preparations
- Grouping of tasks by workstation: Conform to given takt time
- Versatile personnel
- Quality assurance
- Preventive Maintenance

Ahlstorm (2004)

- Elimination of waste
- Zero defects
- Pull
- Continuous Improvement
- Multifunctional Teams
- Decentralization of responsibilities
- Vertical Information system

Apte & Goh (2004)

- Identifying, enhancing & implementing value
- Effective management of supplier relations and information flow.
- Elimination of waste
- Appropriate matching of service capacity to customer-driven demand
- Continuous improvement (kaizen)

Sa´nchez & Pe´rez (2004)

- Elimination of zero-value activities
- Continuous improvement
- Multifunctional teams
- JIT delivery
- Suppliers involvement
- Flexible information system.

Kollberg et.al. (2007)

- Waiting time at specific points in processes.
- Patient/ Customer satisfaction
- Referral management
- Process mapping
- Fulfilment of targets and policies.

Sarkar (2007)

- Leadership
- Functions
- Value Streams
- Anchors (People, Processes, Partners, Promotions & Problem Solving)
- People

- Processes
- Partners
- Promotions
- Problem Solving
- Lean Thinking
- Results

Radnor (2010)

- Understanding demand and capacity
- Understanding value
- Having a process view
- Linking activity to the Strategy
- Strong committed leadership
- Communication strategy
- Training and development
- Steering group and project team

Dahlgaard et al. (2011)

- Leadership
- Cultural Change
- People Management
- Partnerships
- Processes
- Product/Service Results
- Policy Deployment
- Waste Reduction
- Root Cause Analysis

Kundu & Manohar (2012)

- Organization value and culture
- Knowledge management
- Technology management
- Capacity and availability management
- Causal analysis and resolution
- Continuous improvement
- Organizational training
- Supplier agreement and management
- Customer connection
- Value stream
- Visual control

Malmbrandt & Ahlstrom (2013)

- Employee commitment & understanding.
- Employee training,
- Management commitment and understanding.
- Infrastructural elements
- Customer value.
- Identify waste.
- Flow.

- Standardisation
- Level and balance workloads.
- Zero Defects
- Pull
- Visualization
- Multifunctional employees
- Continuous improvement.

Cuatrecasas (2002)

- Linear flow arrangement : Flexible Cells
- Small production batches: a single unit
- Rapid preparations
- Grouping of tasks by workstation: Conform to given takt time
- Versatile personnel
- Quality assurance
- Preventive Maintenance

Bonaccorsi et al. (2011)

- Top Management Commitment
- Employee Engagement
- Team Work
- Training and Learning
- Voice of Customer
- Value Stream Mapping
- Focus on Flow
- Focus on Levelling

Bonneau (2011)

- Process Improvement
- Waste identification and elimination
- Problem Solving
- People and partner
- Voice of Customer
- Value Stream Mapping
- Kaizen
- Heijunka Scheduling

Kuusela & Koivuluoma (2011)

- Top Management Commitment
- Value for stakeholders.
- Focus on value stream
- Cultural and organisational development
- Training
- Value Stream Mapping
- Kaizen
- Lean Assessment

Kreuzer et al. (2011)

- Customer service requirements analysis
- Process description and modelling
- Value Stream Mapping
- Service performance measurement
- Optimisation & service performance improvement
- Continuous Improvement

TCS O-PERA (Optimize- Process, Efficiency, Results Assurance) (2011)

- Focus on Customer
- People
- Process
- Technology
- Shared Services
- Knowledge Management
- Continuous Optimization
- Efficiency Focus

Guimarães & De Carvalho (2012)

- Transformational Leadership
- Willingness to change
- Emotional Competence
- Satisfaction with change
- Relational Competence
- Effective Communication
- Tools & Techniques Training
- Information Seamless Flow
- Material Seamless Flow
- People Seamless Flow
- Lean Sensei
- Value Stream Achievements
- Trust Building
- Emotional Commitment
- Lean Values
- Technical Innovation
- Inter Organisation Achievement

Damrath (2012)

- Value Stream Mapping
- Standardize processes
- Continuous Improvement
- Senior Management Support
- Create Flow
- Waste identification and elimination
- Structured Knowledge Sharing
- Quality Circles
- Structured Problem Solving
- Heijunka Scheduling

To check the reliability and validity of these existing frameworks, a nationwide survey was carried out and details regarding the same are presented in next section.

4.3 Research Methodology for Conducting the Empirical Investigation

The systematic approach as described in chapter of research methodology is followed to conduct the reliability and validity study. A brief description about the same is given below:

4.3.1 Theory Verification

The first step is to empirically analyse the existing lean service frameworks for reliability and validity in Indians Service industry to assess their applicability in Indian Services.

4.3.2 Selecting a Research Design

To accomplish the reliability and validity analysis of the existing lean service frameworks in Indian service industry a cross sectional survey was done as illustrated in chapter of research methodology.

4.3.3 Select a Data Collection Method

A questionnaire survey is selected as data collection method. The questionnaire is administered using emails and personal visits.

4.3.4 Implementation

A cross sectional study was performed on chosen sectors (banking / financial services, healthcare, IT/ITES and telecom). Along with the chosen service sectors the questionnaire was also floated to lean experts (academics and consultants) considering lean is at nascent stage in Indian services. Secondly, experts can give insights into best practices across sectors and functions as they serve multiple clients across different sectors facing similar problems. Consultants also act like trend-setters who create new frames of reference that forces top managers to recognize new methodologies to be adopted as a solution or for sustaining in the market. In order to reduce the subjectivity of the survey, the target respondents chosen were quality/lean practitioners/experts in the selected service sectors. As no directory of quality/lean practitioners/experts is available hence LinkedIn database was used to find the same in the selected sectors. The respondents are top to middle management levels like CEO, Sr. VP, VP, AVP, Head – Quality , GM Quality and Accreditations, Quality Manager, Quality Analyst, Operation Manager, Principal Consultant, Professor and Associate Professor.

A structured questionnaire was developed using five point Likert scale. The details of the same are given in Appendix I. The Likert scale varied from 1 to 5, from not important to most important. The respondents were asked to assign the level based on how important is each element of the framework to the organisation for implementing lean. A typical example is given below:

Framework 1 : Cuatrecasas, A. L. (2002)						
F1.1	Linear flow arrangement : Flexible Cells	**1**	**2**	**3**	**4**	**5**

The questionnaire consists of two sections. The section A aims to frame the profile of the respondent and the service company based on respondents' professional experience and company's quality initiatives etc. Section B is a structured questionnaire developed using five point Likert scale to assess the level of importance of each element given under 18 lean service frameworks selected from literature review.

The questionnaire was accompanied by a covering letter. The letter gives the purpose of the study, the general information and how to fill the questionnaire survey. The respondents were assured of the confidentiality of the information and were welcome to share any other information they want regarding the concept of lean service in Indian service industry. Respondents were asked to consider each framework individually/ stand alone to achieve lean management in services and assign the level of importance to the elements of the framework mentioned as per their expertise. The respondents were asked to discuss over email or mobile phone with researcher regarding any doubts or queries they had related to the questionnaire.

A total of 423 questionnaires were administered by email using survey monkey and personal visits. Subsequently more than 300 reminder emails were sent. Out of 423 questionnaires 103 responses were received. However 11 responses were incomplete and were considered to be invalid. Thus a total of 92 valid responses were received with response rate of 21.8% which can be considered as good in Indian conditions. Similar response rate was achieved by other researchers in literature. Talib et al. (2012) had 28.6% of response rate, Antony & Desai (2009) received 15% response rate and Sharma & Kodali (2012) had 22.72% response rate. The responses includes 12 from academics, 16 from banking/financial services, 14 from consultants, 13 from healthcare, 26 from IT/ITES and 11 from Telecom sector. Non response bias is introduced bias in statistics when respondents differ from non respondents. As sample was adequate from each sector hence non response bias was not calculated. The statistics of individual sector responses are shown in figure 4-1.

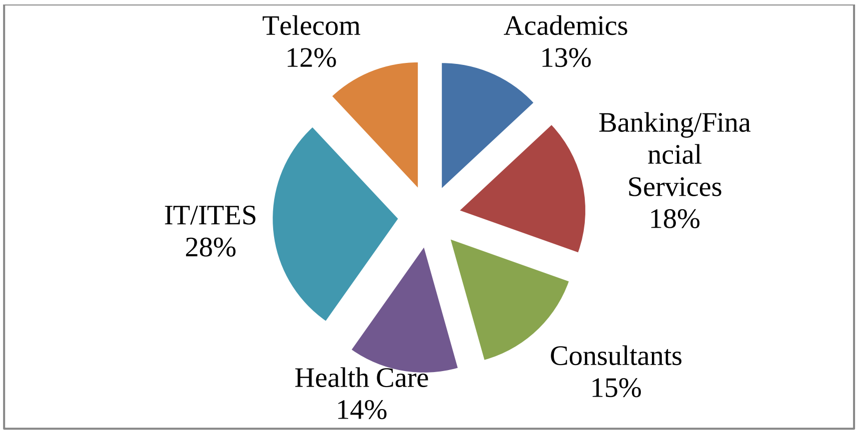


Figure 4-1: Statistics of sector wise responses

4.3.5 Reliability and Validity Analysis

The reliability and validity of existing frameworks of lean in services were investigated in selected Indian service sectors. The same was investigated through the responses collected. To analyse the collected data, the Statistical Package of Social Science (SPSS) version 20 was used.

4.3.5.1 Reliability Analysis: Reliability describes the repeatability and consistency of a test. It checks that whenever the questionnaire instrument is administered to the same person under same settings it produces the same results regardless of person administering them. Thus Reliability is defined as how much frequently the measuring instrument or questionnaire is producing the same outcome on repetitive trails (Toke et al., 2012). It refers to the consistency of a research study or measuring test. In order for the results from a study to be considered valid, the measurement procedure must first be reliable. There are four ways to measure the reliability: test retest method, split halves, internal consistency and equivalent form. The most suitable and reliable method of the four is internal consistency method (Hair et al., 2006; Sureshchandar et al., 2001).The same is used in this study. The most widely accepted measure of internal consistency is Cronbach α, which is an average of the correlation coefficients between items (Nunnallly, 1978).

4.3.5.2 Validity Analysis: The validity of a scale or survey measurement is considered to be the degree to which the tool measures what it claims to measure and nothing else. Validity analysis can be classified into three measures a) Content Validity b) Criterion validity and c) Construct validity. To perform the validity of the questionnaire instrument, reliability test is essential (Sharma & Kodali, 2012).

Content Validity: Content validity is concerned with a scale's or research instrument's ability to include or represent all of the content of a particular construct. It is the degree to which the content of the scale or instrument matches the content area associated with the construct. Content validity can be performed with the help of experts' opinion. Experts are able to review the items, judge and comment whether the items are representative of the construct being measured. It is a qualitative test that measures the extent to which research instrument measures the concept it was intended to measure (Sharma & Kodali, 2008).

Criterion Validity: The extent to which items in a research instrument are actually measuring the real world states or events that they intend to measure. A type of validity that examines whether the measurement scale performs as expected in relation to other selected variables as meaningful criteria (Malhotra & Birks, 1999).The criterion-related validity is done using simple correlation, for testing a scale or items for a single outcome (Sharma & Kodali, 2008)

Construct Validity: A type of validity that addresses the question of what construct or characteristic the scale or research instrument is measuring. It answers hypothetical questions of why a scale works and what inferences can be made concerning the theory underlying the scale. Factor analysis conducted on a single scale will show whether all the items (dimensions) within a summated scale will load on single construct or whether the scale is measuring more than one construct i.e. check the unidimensionality of the scale towards single construct (Sharma & Kodali, 2008) .

4.3.6 Results

As already discussed the questionnaire was divided in two sections. The section A aims to build the profile of the respondent and the service company based on respondents' experience and company's quality initiatives etc. The following section discusses some of the findings of Section A of the instrument giving the overview of lean in service industry.

Out of the 92 respondents 78 respondents have experience of more than five years and 54 respondents have experience of more than 10 years (figure 4-2). This shows that respondents have sufficient knowledge and experience about their work area and process improvement methodologies.

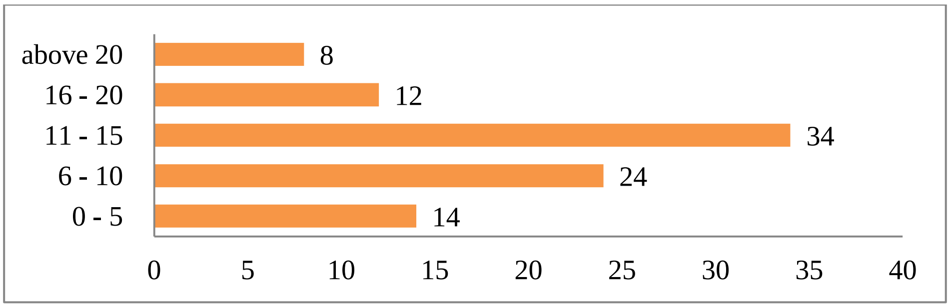
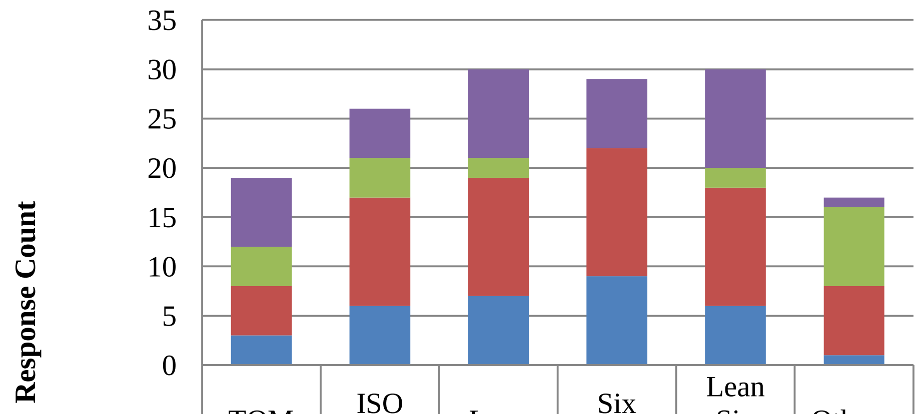


Figure 4-2: Statistics of experience of respondents in years

Few questions aimed at finding the change initiatives being implemented by Indian Service Industry were asked only from industry. Thus 66 valid responds were there from the selected sectors of Indian service industry. 45% of respondents (figure 4-3) voted for Lean and Lean Six Sigma practices while 44% voted for six sigma in reply to question on which change initiatives/ quality/ process improvement methodologies have been adopted by the organisation. These responses are evident enough to infer that the Indian service industry is aware and has adopted lean as one of the effective strategy to achieve operational quality. As stated by respondents various organisations have also implemented NABH (National Accreditation Board for Hospitals & Healthcare Providers) accreditation, CMMI (Capability Maturity Model Integration), BPM (business process management), ISO 20000, ISO 9000, TQM etc. while some have adopted in house developed quality improvement frameworks.



	TQM	ISO 9000	Lean	Six Sigma	Lean Six Sigma	Others
Banking/Financial Services	7	5	9	7	10	1
Health Care	4	4	2	0	2	8
IT/ITES	5	11	12	13	12	7
Telecom	3	6	7	9	6	1

Figure 4-3: Change initiatives/ quality/ process improvement methodologies adopted by Indian service industry

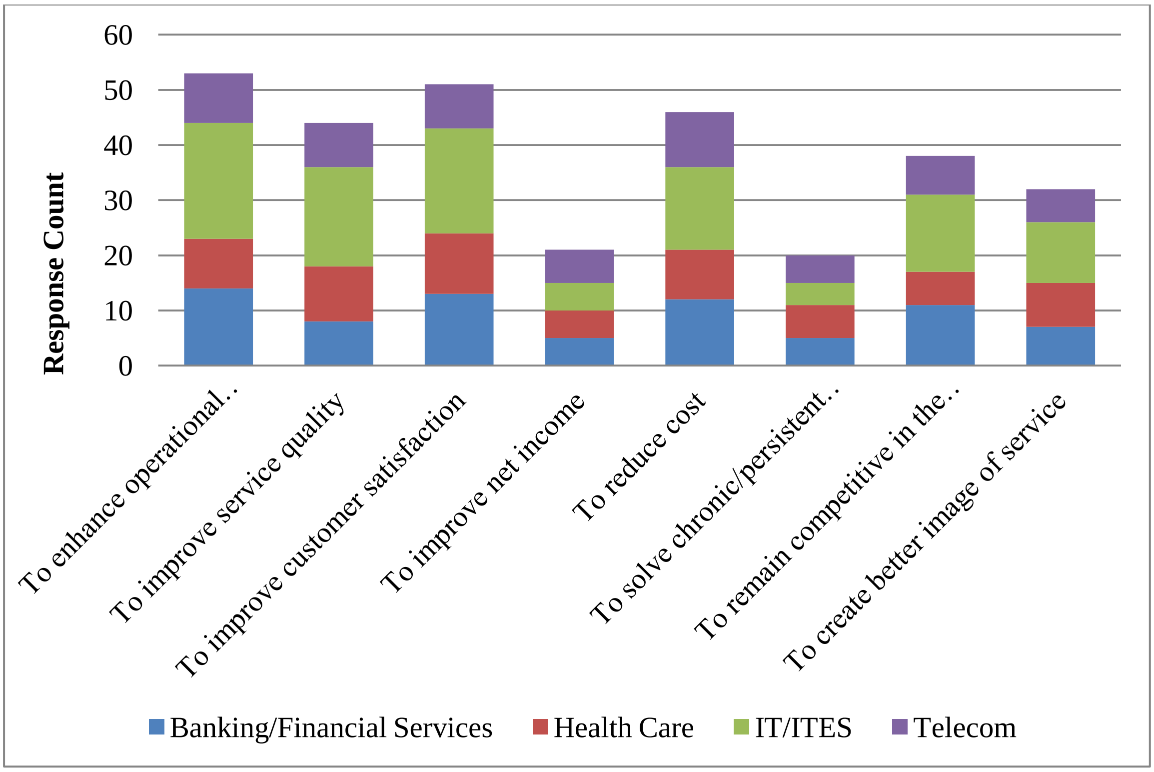


Figure 4-4: Objectives for Implementing Change initiatives/quality/process improvement methodologies

About 80% (53 respondents) of the respondents had indicated enhancing operational excellence/performance as the rationale behind the adoption of change initiatives in response to specifying the objectives to adopt the change initiatives/ quality methodologies (figure 4-4). About 77% (51 respondents) had endorsed improving customer satisfaction for their engagement in change initiatives/quality improvement methodologies to (figure 4-4). Only around 30% indicated that they were using change initiatives/ quality improvement methodologies to improve their net income or to solve a chronic problem.

From the above observations it can be deduced that Indian Service industry has started making inroads into operational and service excellence to remain globally competitive with disappearance of geographical barriers and demanding customers. Advent of medical tourism in healthcare sector and majority of clientele from developed economy in IT/ITES sector have also forced the service industry to adopt globally accepted process improvement methodologies for the same.

Lastly, the reliability and validity of the existing lean service frameworks were done to ascertain if the existing frameworks can be used directly for further study. To assess the content validity of the questionnaire, the preliminary draft of the questionnaire was administered 10 academicians and 4 lean practitioners in industry. Their suggestions were incorporated to get the final version of the questionnaire which was sent to 423 lean experts/practitioners by email using survey monkey and personal visits.

Reliability or internal consistency of the scales/frameworks was done by calculating Cronbach's α coefficient for each framework using inter item analysis. The value of Cronbach's α greater than 0.7, is considered to be good indicator for internal consistency or reliability (Nunnallly, 1978). Since the reliability analysis was performed on existing frameworks and not to test a new questionnaire, Cronbach's α value of 0.8 or more is needed (Nunnallly, 1978). The detailed reliability analysis of each framework is illustrated in Appendix1 from page no AI-1 to AI-18. From the analysis one can deduce that all the frameworks have mean more than 3.5 and Cronbach's α more than 0.8 as shown in table 4.3. Two of the frameworks were having Cronbach's α of 0.78 & more so as it was more than 0.7 and approaching 0.8 hence were accepted.

Table 4-3: Mean and Reliability Analysis results for lean services frameworks.

Framework	Overall Mean	Cronbach's α
Cuatrecasas (2002)	3.522	.784
Comm & Mathaisel (2003)	3.979	.874
Ahlstrom (2004)	3.859	.852
Apte & Goh (2004)	4.057	.869
Sa´nchez & Pe´rez (2004)	3.812	.842
Kollberg et al. (2007)	3.859	.788
Sarkar (2007)	3.982	.918
Radnor (2010)	4.034	.900
Dahlgaard et al. (2011)	4.011	.913
Bonaccorsi (2011)	4.143	.898
Bonneau (2011)	4.053	.912
Kuusela & Koivuluoma (2011)	4.079	.910
Kreuzer et al. (2011)	4.005	.936
TCS (2011)	4.043	.930
Guimarães & de Carvalho (2012)	3.852	.962
Damrath (2012)	3.880	.950
Kundu & Manohar (2012)	3.890	.937
Malmbrandt & Ahlstrom (2013)	3.898	.951

One needs to check criterion related validity after checking the content validity. It measures the extent to which the survey instrument is related to an outcome. As the present study did not include the level of lean service excellence, as it was assumed that the authors have performed validity analysis on their framework in their environment hence criterion related validity of the frameworks was not evaluated. A similar kind of observation was adopted by Sharma & Kodali (2008) and Vamsi Kishna Jasti & Kodali (2014a).

Lastly factor analysis was adopted to assess the frameworks for construct validity. Construct validity verified whether the scales/frameworks measures the Lean as per the theoretical construct it was expected to measure. The scale should be reliable and must be unidimensional (Gerbing & Anderson, 1988; Flynn, et al., 1990) for performing validity analysis. Conducting factor analysis on a single summated scale (framework) will show whether all items within the summated scale load on the same or one construct, or whether the summated scale is actually measures more than one construct (Gerbing & Anderson, 1988; Flynn, et al., 1990). Similar approach was used by Sharma & Kodali (2008) to verify the unidimensionality of existing manufacturing excellence frameworks and by Vamsi Kishna Jasti & Kodali(2014a) to verify the unidimensionlity of existing lean manufacturing frameworks. Hence using the similar approach all frameworks were checked for unidimesionality using factor analysis - Principal Component Analysis (PCA).

Kaiser-Meyer-Olkin (KMO) was adopted in present study as a measure of sample adequacy (Field, 2009). Kaiser (1974) recommends value below .5 as unacceptable, between 0.5-0.7 as mediocre, 0.7 -0.8 as good and 0.8 -0.9 as great and above 0.9 as superb. As listed in table 4-4 the KMO value for framework is between 0.7 and 0.9 and beyond which proves that sample size is adequate to go for factor analysis. The Factor analysis on the eighteen frameworks proposed by various researchers and consultants was conducted and it was found that only nine frameworks displayed unidimensionality. The detailed factor analysis of each framework for checking unidimensionality is available in Appendix 1 page no. AI-19 to AI-36. The numbers of factors extracted from each framework are as shown in table 4.4.

The frameworks showing unidimensionality are:

1. Apte & Goh
2. Sa´nchez & Pe´rez
3. Kollberg et al.
4. Sarkar
5. Radnor
6. Kreuzer et al.
7. TCS
8. Damrath
9. Kundu & Manohar

Table 4-4: KMO value and Factors extracted from each framework for lean services

Framework	KMO	Number of factors
Cuatrecasas (2002)	0.767	2
Comm & Mathaisel (2003)	0.851	2
Ahlstrom (2004)	0.816	2
Apte & Goh (2004)	0.819	1
Sa´nchez & Pe´rez (2004)	0.827	1
Kollberg et al., (2007)	0.804	1
Sarkar (2007)	0.904	1
Radnor (2010)	0.880	1
Dahlgaard et al., (2011)	0.857	2
Bonaccorsi (2011)	0.854	2
Bonneau (2011)	0.873	2
Kuusela & Koivuluoma (2011)	0.849	2
Kreuzer et al., (2011)	0.885	1
TCS (2011)	0.899	1
Guimarães & de Carvalho (2012)	0.892	3
Damrath (2012)	0.921	1
Kundu & Manohar (2012)	0.905	1
Malmbrandt & Ahlstrom (2013)	0.908	2

Subsequently the nine frameworks showing unidimesionality were assessed to identify main items/elements using frequency distribution. Total of 62 elements were selected based on having mode of four or more from these nine frameworks as shown in table 4-5. Sharma and Kodali (2008) and Vamsi Kishna Jasti & Kodali, (2014a) have used similar approach. After removing the overlapping elements; finally 51 elements were selected.

Table 4-5: Elements Selected from Nine Uni Dimensional Framework

S. No	Elements from 9 Unidimensional F/W	Mean	Median	Mode
1	Continuous improvement	4.33	4.50	5
2	Continuous Improvement	4.22	4.00	5
3	Continuous Improvement	4.17	4.00	5
4	Continuous improvement	4.15	4.00	5
5	Continuous Improvement (Kaizen)	4.28	5.00	5
6	Customer service requirements analysis	4.01	4.00	5
7	Elimination of waste	4.16	4.00	5
8	Elimination of zero-value activities	3.87	4.00	5
9	Focus on Customer	4.42	5.00	5
10	Identifying, enhancing & implementing value	4.01	4.00	5
11	Leadership	4.21	4.00	5
12	Patient/ Customer satisfaction	4.38	5.00	5
13	People	4.13	4.00	5
14	Process	4.08	4.00	5
15	Senior Management Support	4.05	4.00	5
16	Strong committed leadership	4.20	4.00	5
17	Anchors b) Processes	3.99	4.00	4
18	Anchors c) Partners	3.82	4.00	4
19	Anchors d) Promotions	3.60	4.00	4
20	Anchors e) Problem Solving	3.98	4.00	4
21	Anchors a) People	4.09	4.00	4
22	Appropriate matching of service capacity to customer-driven demand	4.10	4.00	4
23	Causal analysis and resolution	3.88	4.00	4
24	Communication strategy	4.01	4.00	4
25	Continuous Optimization	4.08	4.00	4
26	Create Flow	3.86	4.00	4
27	Customer connection	4.05	4.00	4
28	Effective management of supplier relations &; information flow.	3.73	4.00	4
29	Efficiency Focus	4.04	4.00	4
30	Fulfilment of targets and policies.	3.96	4.00	4
31	functions	3.76	4.00	4
32	Having a process view	3.92	4.00	4
33	Heijunka Scheduling	3.63	4.00	4
34	Knowledge Management	3.79	4.00	4
35	Knowledge management	3.78	4.00	4
36	Lean Thinking	4.10	4.00	4
37	Linking activity to the Strategy	4.04	4.00	4
38	Multifunctional teams	3.79	4.00	4
39	Optimisation &; service performance improvement	4.05	4.00	4

S. No	Elements from 9 Unidimensional F/W	Mean	Median	Mode
40	Organization value and culture	4.04	4.00	4
41	Organizational training	3.92	4.00	4
42	Process description and modelling	3.85	4.00	4
43	Process mapping	3.99	4.00	4
44	Quality Circles	3.63	4.00	4
45	Results	4.18	4.00	4
46	Service performance measurement	3.92	4.00	4
47	Shared Services	3.76	4.00	4
48	Standardize processes	3.99	4.00	4
49	Steering group and project team	3.87	4.00	4
50	Structured Knowledge Sharing	3.68	4.00	4
51	Structured Problem Solving	3.82	4.00	4
52	Technology	4.04	4.00	4
53	Technology management	3.85	4.00	4
54	Training and development	4.17	4.00	4
55	Understanding demand and capacity	3.95	4.00	4
56	Understanding value	4.17	4.00	4
57	Value stream	3.95	4.00	4
58	Value Stream Mapping	3.98	4.00	4
59	Value Stream Mapping	3.92	4.00	4
60	Value Streams	4.10	4.00	4
61	Visual control	3.68	4.00	4
62	Waste identification and elimination	4.04	4.00	4
63	JIT delivery	3.63	4.00	3
64	Suppliers involvement	3.51	3.00	3
65	Flexible information system.	3.74	4.00	3
66	Waiting time at specific points in processes.	3.63	4.00	3
67	Referral management	3.38	3.00	3
68	Capacity and availability management	3.78	4.00	3
69	Supplier agreement and management	3.68	4.00	3

4.4 Conclusion

The main objective of the chapter was to conduct the reliability and validity analysis of existing lean service frameworks in Indian service industry. The Cronbach's α value is > 0.8 or near 0.8 for all frameworks proved that all of them display high level of reliability. The validity analysis displayed that only nine frameworks displays unidimesionality with respect to the construct they are measuring i.e. lean. Finally using frequency analysis 62 elements were identified for lean services from these nine frameworks having high mean and mode score. The selected elements from these nine frameworks were different with certain amount of overlapping among them. Majority of frameworks are catering to only a particular service area/sector and are developed accordingly. Hence the applicability of same frameworks to different service sector is to be investigated further. Thus there is a need for the new framework having the identified elements and more.

The study further investigated the nine frameworks having unidimesionality and found that some relevant elements were not considered in the existing frameworks for adopting Lean in services. For example, one of the major components is knowledge management which is present only in frameworks with specific sectors. Companies like Infosys, HDFC etc. have built internal portals and do lot of work towards knowledge management. Effective knowledge management not only reduces cost but also increase the speed of response as a direct result of improved knowledge access and application. Some other elements are change management practices, servicescapes and information technology management. These are the elements which play an important role in implementing lean in any service organization, especially looking at current information era and many services being looked as knowledge work. Any change methodology impacts people, processes and performance. To prevent unintended negative outcomes it is crucial to have change management in form of structured processes and set of tools. Servicescape can act as an image differentiation among the competitors. It acts as cue communicating positive message; helping to capture higher market share, customer base and profits. The exponential rate of change in technology, global competitiveness, rise of digital firm and customer awareness makes information technology management essential. Information technology plays an important role in communication and interaction with partners making survival and achievement of strategic goals impossible without extensive use of Information technology.

The study found out that while some Indian frameworks such as Sarkar (2007), TCS (2011) and Kundu & Manohar (2012) are available but some of the relevant elements haven't been included by them. Knowledge management as an initiative is missing in Sarkar (2007). TCS (2011) and Kundu & Manohar, (2012) do not talk anything about key construct top management commitment. None of the three talks about change management practices. TCS (2011) and Kundu and Manohar (2012) framework has been developed for telecom & IT industry respectively so their applicability in other service industry is not validated. Further literature had no article about the validation of Indian frameworks; hence they need to be validated in Indian service sector. Thus it is found that none of the Indian frameworks can be used in its present form as they are unable to fulfil all the requirements.

Although India is portrayed as a major exporter of services, its rank among WTO member countries in services exports is lower than that of China's and its export competitiveness is concentrated in few sectors and few markets (Mukherjee & Goyal, 2012). The Indian market is large and unsaturated, and most services have been opened up for foreign investment after liberalisation in 1990's (Mukherjee, 2013). Domestic players have to compete with foreign counterparts who are having better resources. Most of the sectors in services are unorganised. With the reduction of geographical barriers and the pressure of competing in the global market, overall operational and service excellence have become necessities for the Indian industries to remain globally competitive (Antony & Desai, 2009). Thus in today's era, improving the quality of service delivered along with reduction in cost is necessary to compete successfully and for attracting and retaining the customers. Availability of quality services is vital for the well-being of the economy. Services are continuously looking at new and innovative business improvements and/or process improvement methodologies to reduce cost, improve quality and productivity and to enhance the delivery speed. Indian service industries need overall operational and service excellence and are currently engaged in Quality Circles, TQM and ISO Certification. However, these methods have failed to deliver required performance in Indian industries over the last decade or so (Antony & Desai, 2009).Lean is an effective strategy for improving the business performance by reducing non value added activities to improve the processes. Although many service organisations have successfully adopted the lean methodology, very little research has been carried out relating to the status of lean implementation in the Indian service industry. The use of lean tools to improve service quality is relatively new, with limited reported benefits and approaches. Therefore, there is a requirement for an appropriate framework which addresses the implementation methodology. The development of framework shall be discussed in the next chapter.

CHAPTER 5: DEVELOPMENT OF FRAMEWORK FOR LEAN IN INDIAN SERVICES

5.1 Introduction

As per the changes taking place globally in service industry, the elements identified in previous chapter are not sufficient and there is a need to identify some more elements/constructs that might be needed to fulfil the changing requirements of the Indian service industry as well service industry globally.

Organisations are aiming to create and enhance value from the perspective of customers. Lean tries to shift the organisational focus in eliminating waste leading to create flow efficiency (Modig & Ahlstrom, 2012) resulting into optimising the resource utilisation. The researchers have tried to outline lean services. They have mainly focused on lean practices and tools, such as value stream mapping, cross skilled worker, cause and effect diagram, standardise process, visual management etc. These practices have been implemented as Rapid Improvement Events (RIE). This has led to improvement in short term solving a problem specific to an area; but this silo approach is not going to benefit in long run. To achieve the sustainable benefits of lean in services practitioners require practical and detailed guideline/framework. The absence of practical and detailed guideline/framework ready to be implemented is an issue of concern to organisations who are interested in pursuit of lean for achieving service excellence or competitive advantage in market. There is a need of framework/model for lean in services which can be applied as a series of guidelines directing the improvement process.

Aalbregtse, et al. (1991) recognised that framework illustrates an overview of a philosophy or change process to be adopted so as to communicate a new vision of the organisation. Anand & Kodali (2010) defined it as a guiding torch that helps a manager in providing necessary direction during the change management programmes that are implemented in an organisation. Thus on one hand the framework gives awareness into the organisation’s strength and weakness, on the other hand it guides organisation for meaningful contribution towards stakeholders like society, nations and most importantly the customers. Lean is not just a tool box but represents an approach that has to apply the philosophy and principles behind it for long term sustainable gain.

Framework drives the management to consider key initiatives which contribute strategically to the business which otherwise might not be addressed. These key initiatives do not only influence the implementation but also impact each other. These initiatives in turn lead to enhanced performances and provide a sustainable competitive advantage in the market. Thus it is mandatory to understand the interrelationships among initiatives and relationships between initiatives and performances. Along with key initiatives, the processes and means needed at operational level to be globally competitive needs to be described too. The framework should enable the practitioners to identify, analyse and discuss significant lean service initiatives. This will enable the management to determine their most important improvement processes and capabilities. Thus a comprehensive framework is needed which can be used to establish a mechanism to implement effective and sustainable implementation of Lean in service organisations.

5.2 Lean in Indian Service Industry

Faced with global competition and demanding customers Indian service organisations are increasingly becoming aware about the need to be responsive to the customer's changing demands. And trying to perform in line with these changing demands, they are adopting methodologies to reduce cost, improve quality and making available the desired services to the targeted customers.

Indian Service Industry growing at faster pace as compared to agriculture and manufacturing sectors is the key to make India a part of global power. On one hand with the advent of liberalization and globalization service industry is facing competition from multinational companies. On the other hand advances in technology and the globalization have heightened customer expectations. The other major challenge is to retain and expand competitive advantage in those services where they have already made a mark. New competitors from other developing countries are making rapid strides even in areas where India had the initial advantage like in software services. Thus to compete, the Indian service industry need to be at par with their global competitors and need to adopt lean.

5.3 Need for Framework for Indian Scenario

Every service organisation strives to offer excellent customer service and the success in same depends on the performance of each and every unit in the system. As seen so far achieving excellence in services is an imperative in current knowledge and information era to sustain in global market. Although India is portrayed as a major exporter of services, its rank among WTO member countries in services exports is lower than that of China's and its export competitiveness concentrate in few sectors and a few markets (Mukherjee & Goyal, 2012). The Indian market is large and unsaturated, and most services have been opened up for foreign investment (Mukherjee,2013). Domestic players have to compete with foreign counterparts who are having better resources. Most of the sectors in services are unorganised. With the reduction of geographical barriers and the pressure of competing in the global market, overall operational and service excellence have become necessities for the Indian industries to remain globally competitive (Antony & Desai, 2009).

Indian service industries are too currently engaged in Quality Circles, TQM and ISO Certification for achieving overall operational and service excellence. However, these methods have failed to deliver required performance in Indian industries over the last decade or so (Antony & Desai, 2009). Diaz et al. (2012) and Govindarajan & Ramamurti (2013) have focused on how Indian services are providing world class services at low cost by focussing on removing non value added services to save resources and costs. As per the authors these organisations were not explicitly influenced by lean practices but these lean tools are implicitly present in the processes. There is a requirement for a framework which act as a road map providing direction in implementing lean in Indian services. An appropriate framework suitable for Indian services as well as providing strategic directions is the need of the hour.

The frameworks which have been reviewed are majorly being used in other countries for lean implementation in their domestic environment. Further there is no comprehensive framework for Lean Services. The frameworks so reviewed are catering to a particular service sector. There are significant differences among the frameworks and some are addressing few issues only. Thus the research aims to develop a comprehensive framework for lean implementation in services addressing all issues. The need for the framework is also felt as building a lean organisation is a long term process and piece meal approach is not suitable for its long term sustainment. To build a sustainable Lean foundation that consistently yields dramatic company-wide improvements on a global basis necessitates a roadmap (Pullin, 2005).

The validity and reliability of the existing lean service frameworks in the Indian Services was investigated (Sharma & Gupta, 2015). This research identified that although majority of the frameworks are displaying high level of reliability only few displayed unidimesionality with respect to the construct i.e. lean it measures. Some relevant elements were not considered in the existing frameworks for adopting Lean in services. These elements are change management practices, servicescapes and information and knowledge management except their usage in specific sectors. These are the elements which play an important role in implementing lean in any service organization, specially looking at current information era and many services being looked as knowledge work. The study found out that while some Indian frameworks such as Sarkar (2007), TCS (2011) and Kundu & Manohar (2012) are available but they suffer from various shortcomings. Knowledge management as an initiative is missing in Sarkar (2007). TCS (2011) and Kundu & Manohar (2012) do not talk anything about key construct top management commitment. None of the three talks about change management practices. TCS (2011) and Kundu and Manohar (2012) framework has been developed for telecom & IT industry respectively so their applicability in other service industry is not validated. Thus it is found that none of the Indian frameworks can be used in its present form. The study thus concluded that there is a need of new lean service framework to fill the present void as no existing framework can be used in its existing form.

5.4 Comparison of Lean Service framework in Services

Prior to developing a new framework, an understanding of existing frameworks is required. It is necessary to comprehend the area which have been addressed and areas which are needed to be addressed. The frequency analysis of all 18 frameworks is done to identify which lean elements were majorly considered in literature. The frequency analysis of existing frameworks of Lean services is shown in table 5-1.

	LEAN Elements/Tools/Practices	**Cuatrecasas (2002)**	**Comm & Mathaisel (2003)**	**Ahlstorm (2004)**	**Apte & Goh (2004)**	**Sa´nchez & Pe´rez, (2004)**	**Kollberg et al., (2007)**	**Sarkar (2007)**	**Radnor (2010)**	**Dahlgaard. et al (2011)**	**Bonaccorsi et. al., (2011)**	**Bonneaun (2011)**	**Kuusela & Koivuluoma (2011)**	**Kreuzer, et al., (2011)**	**TCS - Opera (2011)**	**Guimarães & de Carvalho (2012)**	**Damrath (2012)**	**Kundu & Manohar, (2012)**	**Malmbrandt & Ahlstrom (2013)**	**Weight age of each attribute**
1	Continuous Improvement, Continuous process improvement.,		1	1	1	1						1	1	1			1	1	1	0.5556
2	Value Streams, understanding value, Value Stream Mapping, Focus on value stream							1	1		1	1	1	1		1	1	1		0.5
3	Continuously focus on the customer, Patient/ Customer satisfaction, VOC, Customer service requirements analysis, Focus on Customer,		1		1		1				1	1		1	1			1	1	0.5
4	Anchors b) Processes, Process mapping, Having a process view, Processes, Process description & modelling, Standardise Process						1	1	1	1				1	1		1		1	0.4444
5	Leadership, Strong committed leadership, Transformational Leadership, Top Management Commitment, Senior Management Support, Management Commitment & understanding							1	1	1	1		1			1	1		1	0.4444
6	Elimination of waste, Waste Reduction, identification & elimination of waste			1	1	1				1		1					1		1	0.3889
7	Multifunctional Teams, Versatile personnel, Implement integrated product & process development teams, team work	1	1	1		1			1		1								1	0.3889

	LEAN Elements/Tools/Practices	**Cuatrecasas (2002)**	**Comm Mathaisel (2003)**	**Ahlstorm (2004)**	**Apte & Goh (2004)**	**Sa´nchez & Pe´rez(2004)**	**Kollberg et al., (2007)**	**Sarkar (2007)**	**Radnor (2010)**	**Dahlgaard. et al, (2011)**	**Bonaccorsi et. al., (2011)**	**Bonneaun (2011)**	**Kuusela, & Koivuluoma, (2011)**	**Kreuzer, et al., (2011)**	**TCS - Opera (2011)**	**Guimarães & de Carvalho (2012)**	**(Damrath,(2012)**	**Kundu & Manohar (2012)**	**Malmbrandt & Ahlstrom (2013)**	**Weight age of each attribute**
8	Suppliers involvement, Anchors c) Partners, Partnerships, Effective management of supplier relations, Supplier agreement & management				1	1		1		1		1						1		0.3333
9	Anchors a) People, People Management, Employee Engagement, Employee commitment & understanding							1		1	1	1			1				1	0.3333
10	Training and development, Training and Learning, Tools & Techniques Training								1		1		1			1		1	1	0.3333
11	Information Flow/ Info Sys		1	1	1	1										1				0.2778
12	Focus on Flow, create flow		1								1					1	1		1	0.2778
13	Technology, Technology Management, technical innovation		1												1	1		1		0.2222
14	Heijunka Scheduling, level & balance work loads										1	1					1		1	0.2222
15	Cultural Change, Cultural and organisational development, Organization value and culture									1			1					1		0.1667
16	Knowledge Management, Structured Knowledge Sharing														1		1	1		0.1667
17	Anchors e) Problem Solving							1				1					1			0.1667
18	Vertical Information system, Flexible information system.			1		1														0.1111
19	Develop relationships based on mutual trust & commitment., trust building		1													1				0.1111

	LEAN Elements/Tools/Practices	**Cuatrecasas (2002)**	**Comm & Mathaisel(2003)**	**Ahlstorm (2004)**	**Apte & Goh (2004)**	**Sa´nchez & Pe´rez, (2004)**	**Kollberg et al., (2007)**	**Sarkar (2007)**	**Radnor (2010)**	**Dahlgaard. et al, (2011)**	**Bonaccorsi, et. al., (2011)**	**Bonneaun (2011)**	**Kuusela& Koivuluoma, (2011)**	**Kreuzer, E. et al., (2011)**	**TCS - Opera (2011)**	**Guimarães & de Carvalho (2012)**	**Damrath,(2012)**	**Kundu & Manohar (2012)**	**Malmbrandt & Ahlstrom (2013)**	**Weight age of each attribute**
20	Promote lean thinking at all levels.		1					1												0.1111
21	Zero defects			1															1	0.1111
22	Pull			1															1	0.1111
23	Appropriate matching of service capacity to customer-driven demand				1				1											0.1111
24	Visual control, Visualisation																	1	1	0.1111
25	Results, Product/Service Results							1		1										0.1111
26	Root Cause Analysis, Causal Analysis & resolution									1								1		0.1111
27	Provide processes for seamless & timely transfer & access to pertinent data & information,		1																	0.0556
28	Provide technologies for seamless & timely transfer & access to pertinent data & information,		1																	0.0556
29	Linear flow arrangement : Flexible Cells	1																		0.0556
30	Small production batches: a single unit	1																		0.0556
31	Rapid preparations	1																		0.0556
32	Grouping of tasks by workstation: Conform to given	1																		0.0556
33	Quality assurance	1																		0.0556
34	Preventive Maintenance	1																		0.0556
35	Optimize the flow of products & services.		1																	0.0556

	LEAN Elements/Tools/Practices	**Cuatrecasas (2002)**	**Comm & Mathaisel(2003)**	**Ahlstorm (2004)**	**Apte & Goh (2004)**	**Sa´nchez & Pe´rez, (2004)**	**Kollberg et al., (2007)**	**Sarkar (2007)**	**Radnor (2010)**	**Dahlgaard. et al, (2011)**	**Bonaccorsi, et. al., (2011)**	**Bonneaun (2011)**	**Kuusela& Koivuluoma, (2011)**	**Kreuzer, E. et al., (2011)**	**TCS - Opera (2011)**	**Guimarães & de Carvalho (2012)**	**Damrath,(2012)**	**Kundu & Manohar (2012)**	**Malmbrandt & Ahlstrom (2013)**	**Weight age of each attribute**
36	Optimize the capability & utilization of people.		1																	0.0556
37	Maximize stability in a changing environment.		1																	0.0556
38	Decentralization of responsibilities			1																0.0556
39	JIT delivery					1														0.0556
40	Waiting time at specific points in processes.						1													0.0556
41	Referral management						1													0.0556
42	Fulfilment of targets and policies.						1													0.0556
43	Functions							1												0.0556
44	Anchors d) Promotions							1												0.0556
45	Linking activity to the Strategy								1											0.0556
46	Communication strategy								1											0.0556
47	Steering group and project team								1											0.0556
48	Policy Deployment									1										0.0556
49	Team Work										1									0.0556
50	Focus on Leveling										1									0.0556
51	Value for stakeholders.												1							0.0556
52	Lean assessment												1							0.0556
53	Service performance measurement													1						0.0556
54	Optimisation & service performance improvement													1						0.0556
55	Shared Services														1					0.0556
56	Continuous Optimization														1					0.0556
57	Efficiency Focus														1					0.0556

	LEAN Elements/Tools/Practices	Cuatrecasas (2002)	Comm & Mathaisel(2003)	Ahlstorm (2004)	Apte & Goh (2004)	Sa´nchez & Pe´rez, (2004)	Kollberg et al., (2007)	Sarkar (2007)	Radnor (2010)	Dahlgaard. et al, (2011)	Bonaccorsi, et. al., (2011)	Bonneaun (2011)	Kuusela& Koivuluoma, (2011)	Kreuzer, E. et al., (2011)	TCS - Opera (2011)	Guimarães & de Carvalho (2012)	Damrath,(2012)	Kundu & Manohar (2012)	Malmbrandt & Ahlstrom (2013)	Weight age of each attribute
58	Willingness to change															1				0.0556
59	Emotional Competence															1				0.0556
60	Satisfaction with change															1				0.0556
61	Relational Competence															1				0.0556
62	Effective Communication															1				0.0556
63	Material Seamless Flow															1				0.0556
64	People Seamless Flow															1				0.0556
65	Lean Sensei (Mentor / Teacher)															1				0.0556
66	Value Stream Achievements															1				0.0556
67	Emotional Commitment															1				0.0556
68	Lean Values															1				0.0556
69	Technical Innovation															1				0.0556
70	Inter Organisation Achievement															1				0.0556
71	Quality Circles																1			0.0556
72	Capacity and availability management																	1		0.0556
73	Infrastructural elements																		1	0.0556
74	Multifunctional employees																		1	0.0556

Table 5-1: Frequency Analysis of Existing Frameworks of Lean Services

The objective of frequency analysis is to identify the elements/constructs of the framework for adopting lean in services. The table shows a matrix of numbers, the unique elements of Lean services that are listed row-wise on the left-hand side of the table, in column 2, are considered by the authors listed column-wise. The 18 frameworks identified from extensive literature review, had 158 elements. These elements/ constructs/factors represent the initiatives to achieve lean in services. Some elements were analysed further and those elements (or constructs) were clubbed together which were either using the same word(s) or had same meaning. For example continuously focus on the customer; Patient/ Customer satisfaction, VOC, Customer service requirements analysis, Focus on Customer were clubbed together under Customer Relationship Management. Thus we got the list of 74 unique elements of lean services.

Identifying and establishing these relationship results into development of new structure or a framework which will provide an approach for implementing lean in services. From comparative analysis the elements having frequency of 20% or more are considered as important elements for lean services. Some elements were analysed further and similar elements were put together. These repetitive elements/initiatives are called as "pillars/building blocks" as they become critical for achieving lean. Thus through the comparative analysis some unique elements/attributes were identified which represent the pillars of lean services, and through domain knowledge some more elements/attributes were added as new pillars to already identified pillars through the comparative analysis. The pillars of the framework for lean services are shown in table 5-2.

Table 5-2: Elements/Pillars of Lean Services

S. No	Pillars/Initiatives
1	Top Management Commitment
2	Human Resource and Change Management
3	Customer Relationship Management
4	Elimination of Waste
5	Continuous Process Improvement
6	Supplier Management
7	Knowledge Management
8	Technology Management
9	Servicescape

5.5 Development of Framework of Lean Services

The framework for lean in services has been developed using literature review, domain knowledge, frequency analysis etc. The step by step method of development of framework is discussed below:

Using frequency analysis unique elements/initiatives for lean services were identified. Through domain knowledge and discussion with practitioners/experts some more elements were identified and analysed further to put under various pillars of lean services as depicted in figure 5-1. A brief discussion about these pillars is given in the subsections followed.

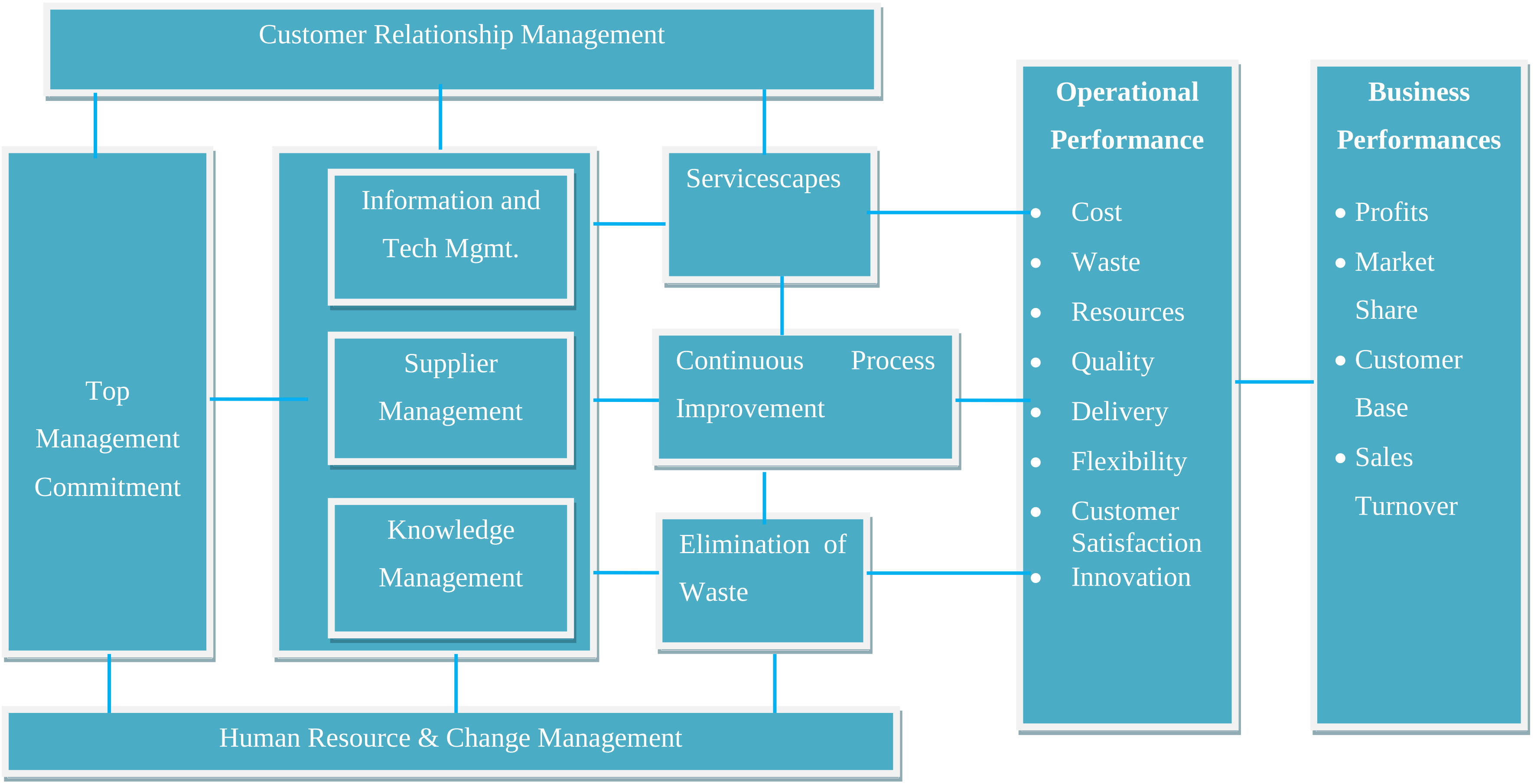


Figure 5-1: Conceptual Framework of Lean Services

5.5.1 Top Management Commitment

This pillar talks about the top management role and responsibilities in implementing lean in services. More than 60% of the framework/studies have talked about it hence it is considered as an important pillar for lean services. Learning lean tools and techniques is only a small part of lean. The most important part of lean management is leadership (Radnor, 2010). The foundation for the lean system is leadership and empowerment through education and training (Dahlgaard & Dahlgaard-Park, 2006; Kundu & Manohar, 2012). Managers and their actions can make the difference between a successful and unsuccessful lean adoption effort (Radnor, 2010; Sua´rez-Barraza & Ramis-Pujol, 2010; Malmbrandt & Ahlstrom, 2013). The shared vision of the lean transformation is sponsored (financially, clear vision, in time and spirit) and supported by the top management and transferred to all the employees, for successful implementation of Lean concepts (Holmes, 2007; Sarkar, 2007; Damrath, 2012; Malmbrandt & Ahlstrom, 2013). The planned strategy for lean adoption is initiated from the top management. Besides self learning the management has to motivate other to learn and practice lean practices. The management should build mindset of continuous improvement in the organization. Although the transformation into lean is often driven from the bottom, it is important that top management lead the journey in its initial stages.

The remaining elements under the various framework was analysed further and some elements were identified which can be put under Top Management Commitment pillar. Along with this extensive literature search was done to identify various other elements under Top Management Commitment. Based on extensive literature (Sa´nchez & Pe´rez, 2004; Holmes, 2007; Sarkar, 2007; Bonaccorsi, 2011; Dahlgaard et al., 2011; Damrath, 2012; Guimarães & De Carvalho, 2012; Malmbrandt & Ahlstrom, 2013) various elements were identified which can be put under Top Management Commitment pillar. These elements are as listed below:

- Transformational Leadership
- Vision, Mission and Strategies
- Planning for Lean
- Resource allocation
- Practice Lean

5.5.2 Human Resource and Change Management

Human resource is an asset to the service organization as they are the backbone of the organization. It is the people which decide the success or failure of any organization. Service organizations are essentially big “people machines,” where having a high level of turnover is just as deadly as if a manufacturer was constantly asked to change machine parts (George, 2003). For service industry in some sense HR is more important than manufacturing as there is a high degree of contact between customer and servers. Servers being co-producer are responsible for creating brand value of their organization too. The organisations need to retain and build human capital for its competitive advantage (George, 2003). Lean itself is a change management initiative and most important is managing change

Majority of the studies and framework (82%) have covered this and hence it is considered as one of the most important initiative of Lean services. This encompasses employee engagement, employee empowerment, training and development, rewards and incentives, change management. Employees are assets and are treated as partners. They are given regular training to enhance their skills. Organisation creates the culture of lean and enhances initiatives and innovation. It is often stated that core to the success of Lean implementation is ensuring changes in mindsets through a strategy which consists of both tools/techniques and cultural changes (Spear & Bowen, 1999; Shah & Ward, 2007; Radnor, 2010).

Lean is a journey and takes time and, people need time to engage with and embed (Radnor & Walley, 2008). It requires changes and adjustments in the work organization, including employee’s responsibilities, rewards, and incentives (Damrath, 2012). The tools of Lean are used not only to create technical change but also behavioural or culture change which allows the dynamic learning process to be created (Radnor, 2010). Culture refers to shared language, symbols, beliefs, and values (Liker & Morgan, 2006). Resistance to change can be avoided by engaging people in shaping the initiative in ways that support their personal goals and training all top managers, creating enthusiasm rather than compliance (George, 2003). The principles of people systems are all about developing people who challenge, think, and continuously improve the product and process. People working on the process should have the tools and are motivated to first contain the problems and then solve them at the root cause (Liker & Morgan, 2006). Centring on the people who add value means upgrading their skills using training, forming teams that design their own processes and staff groups and managers exist to support employees (Poppendieck, 2002). Cross- functional teams are key in people-based services, since the role and competence of service employees are both different and in some sense more important in services than in manufacturing (Ahlstrom, 2004).Trainings can be given statistical process control, lean tools and number of other functional areas (Karlsson & Ahlstorm, 1995) developing the cross skills of the employees. Andon cord can be used by employees to signal need for help to the managers in form of assistance or training needs (Staats et al, 2011).

Services need single pool of cross-skilled workers so that any operative could completely resolve any customer enquiry. Piercy & Rich (2009) and Kundu & Manohar (2012) advocate use of cross functional team using scientific method for process improvement and implementation. Another important characteristics of lean work organization is that responsibilities are decentralized onto the multifunctional teams (Karlsson & Ahlstorm, 1996) shifting responsibility and authority. This on one had reduces hierarchy level and helps in quick decision making leading to better customer satisfaction. The reward and remuneration system has to be revised to taken into account lean skills developed and lean outcomes achieved. As Karlsson & Ahlstorm, (1996) suggest they have to include individual competence ladder anc certain part should be oriented towards team achievements.

The remaining elements under the various framework was analysed further and some elements were identified which can be put under Human Resource and Change Management pillar. Along with this extensive literature search was done to identify various other elements under Human Resource and Change Management. Based on the literature (Middleton, 2001; George, 2003; May, 2005; Spear, 2005; Liker & Morgan, 2006; Malladi et al., 2011; Morrow et al., 2012) various enablers were identified as given below:

- Cultural Change
- People Motivation
- Respect for People

- Employee Empowerment
- Employee Satisfaction
- Employee Engagement
- Training and Development
- Rewards and Incentives
- Team work

5.5.3 Customer Relationship Management

The present turbulent business environment calls for constant striving to meet customer needs and improve one's process with zero defects. The lean thinking highlights the importance of customer values (Kuusela & Koivuluoma, 2011). Lean in any company starts from the voice of customer. The very concept of "value" in lean says value is any action or process that a customer would be willing to pay for or the use that a product offers a customer (Staats et al., 2011). As per Robson (1986), customers for excellent companies are not only the people to whom the company product is sold to. Everyone within the organisation both is a customer and server. The internal customers are important in the same degree as external customer. If the internal customers are satisfied and are happy, then they will do things which will be naturally making the external customers extremely happy, which in turn will take care of the organisation growth and market. The linkage between employee satisfaction and customer satisfaction has been empirically verified in a number of settings (Gro¨nroos, 2000; Fitzsimmons & Fitzsimmons, 2006; Keiningham et al., 2006; Piercy & Rich, 2009).

Nearly 58% of the researchers/academicians have considered this as an important attribute/pillar for lean services. The establishment of customer contacts is important to consider in both the manufacturing and services (Kollberg et al., 2007). Services often demand the customer to be present and to a high extent involved in the "production" of the service, (Swank, 2003; Apte & Goh, 2004; Malmbrandt & Ahlstrom, 2013). The organisations adopting lean create and maintain relationships with customers in requirements generation, development, delivery, support and solution-based problem solving. Suggestions for making the practice more acceptable to customers include educating customers (Kimes, 2002) and compensating customers for excessive waiting time (LaGanga, 2011). LaGanga (2011) has advocated staff/consumer partnership council which involves consumer in identifying and participating in actions that improve service delivery. Improvement groups within organisation should also focus on customers problems and needs (Dahlgaard et al., 2011) to gain knowledge of all factors that are causing customer dissatisfaction (Kreuzer et al., 2011). Customer involvement improves customers' learning and educates customers about potential possibilities. Customer involvement ranges from annual surveys to close cooperation with customers in improvement efforts (Malmbrandt & Ahlstrom, 2013). Along with customer orientation need of the hour is to focus on cross functional processes and activities directed at creating and satisfying customers through continuous need assessment (Piercy & Rich, 2009). Services have to be redesigned to improve the delivery along with fulfilling all customer needs. New performance system which has a scale to measure satisfaction level of fulfilment of customer requirement should be devised instead of traditional measures.

The remaining elements under the various framework was analysed further and some elements were identified which can be put under Customer Relationship Management pillar. Along with this extensive literature search was done to identify various other elements under Customer Relationship Management. Based on extensive literature (Apte & Goh, 2004; May, 2005; Abdi et al., 2006; Kollberg et al., 2007; LaGanga, 2011; Malladi et al., 2011; Díaz et al., 2012; Kundu & Manohar, 2012; Malmbrandt & Ahlstrom, 2013) various elements were identified which can be put under Customer Relationship Management pillar. These elements are as listed below:

- Voice of customer
- Customer Satisfaction
- Customer Relationship
- Customer Involvement
- Service Design/Delivery

5.5.4 Elimination of Waste

Lean is a complete management system for the elimination of waste (Middleton, 2001). Within 'Lean Thinking' the waste is defined as any human activity, which absorbs resources but creates no value (Womack & Jones, 1996). The customer is not willing to pay for waste and therefore it should be eliminated. Since service processes are seldom carefully designed (Shostack, 1984) there is ample opportunity for eliminating waste and redundancy and focusing on the core competencies of the organisation. The starting point is to recognise that only a small fraction of the total time and effort in any organisation actually adds value for the end customer (Sa´nchez & Pe´rez, 2004; Sarkar, 2007).

Through using the acid test of customer value and eliminating everything that does not add value to the customer; elimination waste can be applied to service processes (Ahlstrom, 2004). But here the acid test has to be applied carefully as what customer is paying is also a function of experience and outcome. Customers being a part of production process in many services demand/ expectations may vary from customer to customer. If services are able to adjust their approach to that demand, then they can fluidly meet the requirements and expectations of customers (Abdi et al., 2006).

More than 72% of the researchers have considered elimination of waste and hence it is taken as an important pillar of lean in services. Lean when implemented correctly should result in the elimination of “muda” or waste and more efficient processes that provide better value to the customer (Comm L. & Mathaisel, 2005). By eliminating waste we can simultaneously reduce our costs, make better use of our resources and deliver better customer value (Abdi et al., 2006).Various authors like Womack et al. (1990), Middleton (2001), Wei (2009) have talked about eight wastes in any processes. They are overproduction, waiting time, transportation, motion, defects/errors, over processing and inventory. As in services human element is one of the most important elements hence untapped human potential can also be considered as a waste (Abdi et al., 2006). People have to change their mindset to create holistic view of seeing the whole and not only the part have they played. This will help to understand what other people do and then identify where waste can be eliminated (Abdi et al., 2006). This first step involves walking along the operation processes (Gemba) that form the value stream and then document the stream with visual stream mapping (Bonaccorsi, 2011; Wei, 2009). VSM and visual management leads to potential gains in reducing errors (Condel et al., 2004; Brandao de Souza, 2009). Visual management can be operationalized using three lean service practice items: use of visual signals, visualization of general information, and visualization of improvements (Malmbrandt & Ahlstrom, 2013)

Middleton (2001) and Wei (2009) have emphasised on focusing development of tools and processes that eliminate errors as close to the source of the error as possible thus preventing them to move downstream aiming for zero defects and quality at source. The error-proofing and visual control helps to reduce variability early on before it is too late to reverse a service failure (Wei, 2009). Thus the systematic elimination of waste will reduce the costs of operating the extended enterprise and fulfils the end-use customer's desire for maximum value at the lowest price (Ahlstrom, 2004; Sa´nchez & Pe´rez, 2004).

The remaining elements under the various framework was analysed further and some elements were identified which can be put under Elimination of Waste pillar. Along with this extensive literature search was done to identify various other elements under Elimination of Waste. Based on the literature (Comm & Mathaisel, 2003; Apte & Goh, 2004; Koll berg et al., 2007; Radnor, 2010; Bonaccorsi, 2011; Bonneau, 2011; Kundu & Manohar, 2012; Malmbrandt & Ahlstrom, 2013) various enablers were identified as given below:

- Value Stream Mapping
- Visualisation
- Elimination/Reducing Waste
- Zero defects
- Quality at Source

5.5.5 Continuous Process Improvement

Continuous process improvement is the incremental improvement of processes through incremental or breakthrough improvements. It is getting better all the time (Fryer et al., 2007) .Majority of the studies and framework (62%) have covered this and hence it is considered as one of the most important initiative of Lean services. Many organisations use the approach known as kaizen. Kai means "change" and zen means "good" i.e. "Improvement". This improvement approaches forces the manger to plan better and to monitor closely leading to improvement in performance (Staats et al., 2011). Spear & Bowen (1999), Liker (2004) and Kundu & Manohar (2012) have emphasised on need to establish Continuous improvement as a culture by developing a policy for the same.

They have emphasised on establishing continuous improvement and continual response to problems.

Lean practices related to continuous improvement are detailed and specific. Standardise processes explains how to perform the tasks in the most efficient manner. Liker (2004) defines it as foundation for continuous improvement. Processes should be standardised around best practice allowing them to run more smoothly, freeing up time for creativity and innovation (Womack & Jones, 1996; Radnor, 2010). Emilani (2008) has talked about three elements of standardised work as facilitating information flow, describing business principles that leaders can use to perform their work and implementing a standard skill set for smooth operation of processes. Sa´nchez & Pe´rez (2004), Emiliani (2008), Radnor (2010) and Damrath (2012) have emphasised on necessity to review or define appropriate business measure to measure the results of the standards and to make corrections to avoid deviations. Performance measures drives personal behaviour and are also control measures of service processes. They are needed to be aligned with the specific Lean target. If there are no standards it is not possible to improve by definition (Bicheno, 2008).

Lean production is built around the approach of continuous-flow instead of traditional batch process (Womack & Jones, 1996; Swank, 2003; Radnor, 2010; Damrath, 2012). Authors such as Sa´nchez & Pe´rez (2004), Radnor (2010), Bonneau(2011), Staats et al. (2011) and Kundu & Manohar (2012) have emphasised on using different quality improvement tools like 5S, fish bone diagram, Pareto analysis etc to detect root cause of inefficiencies and apply effective countermeasures which helps in continuous improvement. Staats et al. (2011) says that to maximise chances of effective problem resolution one should adopt structured problem solving process. Liker (2004) recognises 5S system as a tool to help make problems visible and a part of a visual control system. George (2003), Ahlstrom (2004), Wang et al. (2012) and Malmbrandt & Ahlstrom (2013) have raised the importance of built in quality. Apte & Goh (2004), Liker (2004), Bonaccorsi (2011) and Kundu et al. (2011) has stressed on the use Heijunka in services by fitting customer demand in levelled schedule and by establishing standard times for delivering different types of services.

The remaining elements under the various framework was analysed further and some elements were identified which can be put under Continuous Improvement pillar. Along with this extensive literature search was done to identify various other elements under Continuous Improvement. Based on the literature (George, 2003; Sarkar, 2007; Radnor, 2010; Bonaccorsi, 2011; Bonneau, 2011; Kuusela & Koivuluoma, 2011; Damrath, 2012; Kundu & Manohar, 2012; Wang et al., 2012; Malmbrandt & Ahlstrom, 2013) various enablers were identified as given below:

- Kaizen
- Standardise Processes
- Continuous Flow
- 5 S
- Root Cause Analysis Tools
- Set of metrics
- Periodic Reviews
- Quality Assurance
- Process Innovation
- Heijunka

5.5.6 Supplier Management

The value stream of any product/service spans from supplier to producer to the final customer. Many of the studies and framework (20%) have covered this and hence it is considered as one of the most important initiative of Lean services. As lean covers the whole value chain hence it is necessary that organization focuses on whole value chain (Kundu & Manohar, 2012) and touches the suppliers/ vendors too; treating them as an extension/partners of the organisation (Dahlgaard et al., 2011; Kundu & Manohar, 2012). Suppliers can supply a part in a process flow or may provide support to the processes in value stream or a third party services. In services we generally don't have suppliers supplying parts instead these suppliers are information providers or other service companies providing a part of service to customers like logging complaints or post service feedback .In case of healthcare many times it's the customer who is supplier of information. Close and friendly interaction is needed with the customer/supplier to get relevance information to accurately diagnose and treat the patient. The main difference between suppliers in manufacturing and services is the supply of tangible product verses intangible information, and unidirectional versus bi-directional flow of parts/information (Apte & Goh, 2004). Like in insurance services number of suppliers includes independent adjusters, and medical, legal, and engineering professionals to respond to the claimant. For quick response of claims and eliminating waste of waiting time timely availability of information is must. Similar to lean manufacturers, appropriate quantity and quality of inputs (i.e., information) must be provided to information intensive services to get defect free services (Apte & Goh, 2004).

Close partnership and free information flow is mandatory especially when the flow is bidirectional (Apte & Goh, 2004; Dahlgaard et al., 2011; Kundu & Manohar, 2012). There is a need of agreements and yearly goals for external customer-supplier relationships (George, 2003; Dahlgaard et al., 2011) to have win- win situation. Supplier Management ensures that services and configuration items, which are necessary for the service delivery, are available as requested and as agreed at the service level. Similar to manufacturing, for services to operate in a lean manner, the inputs (i.e., intangible information) must be provided in a timely manner and they must be of high quality (Apte & Goh, 2004). As every external supplier induced increases risk because of lesser control hence supplier needs to be carefully assessed and sufficiently tested in order to avoid service disruption or degradation of service quality.SLAs (Service Level Agreement) should clearly state the metrics that will be tracked and measured (Sarkar, 2007; Staats et al., 2011). Suppliers should be integrated into the development process with compatible capabilities and culture (Liker & Morgan, 2006) and should be brought in the processes early on like at design stage (Sa´nchez & Pe´rez, 2004). The organisation should provide technical assistance to suppliers and they are trained and educated to achieve quality performance.

Feedback and periodic reviews highlights the issues and leads to mature learning (Malladi et al., 2011). Robust partnerships and continuous communication leverage the mutual strengths (Malladi et al., 2011) which are reflected is the quality of services provided to customers. Supplier partnership and engagement should help in serving the customer better and improving competitiveness of the company. The organisation should strive to train the suppliers on skills and competencies and share best practices.

The remaining elements under the various framework was analysed further and some elements were identified which can be put under Supplier Management pillar. Along with this extensive literature search was done to identify various other elements Supplier Management. Based on the literature (Apte & Goh, 2004; Sa´nchez & Pe´rez, 2004; Liker & Morgan, 2006; Dahlgaard et al., 2011; Malladi et al., 2011; Kundu & Manohar, 2012; Talib et al., 2013) various enablers were identified as given below:

- Supplier Partnership
- Information Sharing
- Supplier Feedback/Suggestions
- Supplier Development

5.5.7 Information and Technology Management

Information Technology has become an integral part of any business today. Information and technology management is about managing technology resources as per needs and priorities to gain or sustain competitive advantage. It is as an important pillar of Lean Services framework by looking at multifaceted role it is playing in communication, managing partners, improving processes and managing relationship with customers. The spotlight is here is on how value creation can be made possible by technology. IT is more important in services as services deals with network and interaction of external and internal people. Thus technology needs to play synergistic role and needed to be aligned with business strategies.

Many emerging technologies are being used to improve product availability, exalting customer service and providing better operational efficiency (Sarkar, 2007) the aim of lean management. Technology requirements have to be understood as per business needs and the alternatives and sources are identified accordingly (Kundu & Manohar, 2012). Timely and accurate availability of information helps in doing the right thing first time and every time along with reduction in cycle time thus enhancing customer satisfaction. One important way of reducing waste in services is using the advances in information technologies. An example may be of banking industry which has shifted many of its customer services and interactions online. It leads to saving on waiting time which customers spend in queue. Similarly, medical history of patients in database and timely access to the same saves crucial minutes in diagnoses and timely treatment of the patients. Timely and continuous flow of information is needed in multifunctional teams to achieve organisational goals (Karlsson & Ahlstorm, 1996). Use of IT reduced both the required time and the costs in service delivering and also for control.

Use of IT has now made it possible for service companies to produce and deliver customized service at the low cost enabling them to better serve its customers (Apte & Goh, 2004). Recent market trends and customer needs can be known in advance by using the advances in databases and the service design can be changed and leading to higher customer satisfaction. Technological advancements intended to improve productivity may change service process designs enabling not only more self-service activities, but also more activities performed without direct customer contact (Carlborg et al., 2013) thus helping in reduction of waste in terms of human effort, time and material. Technology should be reliable and thoroughly tested to serve processes and people. One need to test and modify technology if there is chance of disruption in stability, predictability or reliability (Kundu & Manohar, 2012).

IT helps in locating and flowing information based on where & when it will be needed in process to facilitate flow (Ahlstrom, 2004; Sarkar, 2007; Guimarães & De Carvalho, 2012; Malmbrandt & Ahlstrom, 2013). The better flow of information and better communication between different functional areas led to swifter and smoother work processes and customer services (Barraza et al., 2009; Sperl et al., 2013), cost reduction and improved efficiency (Emiliani, 2004; Maleyeff, 2006; Guimarães & Carvalho, 2013). It also helps in moving the decision making down the hierarchy thus leading to problem solving by process owners a guiding principle of lean management. Accuracy, timeliness, relevance, reliability, quantity and form of information are crucial to the efficiency of the overall process (Allway & Corbett, 2002; De Koning et al., 2008; Bonaccorsi, 2011) and for all users (Teh et al., 2009; Talib et al., 2013) leading in further improvements of processes and service provided(Bhat et al., 2014). Information clarity leads to streamlined communications and simple process architectures, helping employees spend less time thinking about what to do and instead work to accomplish the task (Staats et al, 2011).

The remaining elements under the various framework was analysed further and some elements were identified which can be put under Information and Technology

Management pillar. Along with this extensive literature search was done to identify various other elements Information and Technology Management Based on the literature (Ahlstrom, 2004; Apte & Goh, 2004; Abdi et al., 2006; Liker & Morgan, 2006; Sarkar, 2007; Malladi et al., 2011; Kundu & Manohar, 2012; Malmbrandt & Ahlstrom, 2013) various enablers were identified as given below:

- Quality Information
- Information Availability
- Technical Systems
- Technological Capabilities

5.5.8 Knowledge Management

Knowledge is the only meaningful economic resource and the processes by which knowledge is created or acquired, communicated, applied and utilized must be effectively managed (Drucker, 1995). Thus knowledge has to be strategically managed for competitive edge. Knowledge management has become especially relevant in developing economies because of high level of attrition. As individuals switches jobs he carries with them individual expertise and organisation has to reinvent the wheel (Sarkar, 2007). The need is to transform tacit individual knowledge into explicit organizational knowledge through cooperation and collaboration (Liker & Morgan, 2006; Sarkar, 2007; Arlbjørn et al., 2011; Staats et al., 2011; Kundu & Manohar, 2012). It is more important in a service/knowledge work environment, because of human intervention. Although very few frameworks have considered it as a major initiative for achieving Lean Services. Seeing its importance in present knowledge era and discussions with experts it has been added as an important initiative of lean services.

Numbers of authors such as Spear & Bowen (1999), Sarkar (2007) and Wang et al. (2008) have believed knowledge to be a key strategic asset for organizations. Liker & Morgan (2006) and Kundu & Manohar (2012) have stressed on building competence by enhancing skills and knowledge. Malladi et al., (2011) viewed reusing organisation-wide knowledge as the step towards continuous improvement. Knowledge management leads to increased learning ability (Liker & Morgan, 2006) , preventing repetition of mistakes which in turns improves the effectiveness of all key activities ability (Tesch et al., 2009; Kundu & Manohar, 2012). It also helps in reduction of variations in service provided by helping in sharing the standards, best practices and information. Lean's A3 process helps in documenting, communicating and sharing the knowledge along with problem solving. Similarly the Andon cord pulled by employees can be documented and shared further for learning process.

Authors like (Spear & Bowen, 1999; Allway & Corbett, 2002; Liker & Morgan, 2006; Staats et al., 2011; Kundu & Manohar, 2012; Malmbrandt & Ahlstrom, 2013) have advocated capturing accumulated learning about a process up to a point and standardizing the best practices leading to more effective learning and improvement. Standardization of procedures also ensures a consistent level of service. Knowledge Management also can solve the problem of delivering high value information to inside staff and top management to prevent miss communication, understanding voice of customer and aiding in quick decision making by reducing time to find key information

Malladi et al. (2011) have talked about improvement of quality of the work products and technical deliverables due to comprehensive understanding, knowledge sharing and reviews which leads to better customer satisfaction. Emiliani (2008) and Morrow et al. (2012) have stressed on impact of sharing knowledge and experience like improved working relationships, communication, improved staff skills Maleyeff (2006) has talked about how knowledge management leads to informed decision making leading to better customer service. If services use knowledge management in their Lean management, then problems of service failure, cost and decisions can be solved.

The remaining elements under the various framework was analysed further and some elements were identified which can be put under Knowledge Management pillar. Along with this extensive literature search was done to identify various other Knowledge Management. Based on the literature (Allway & Corbett, 2002; Liker & Morgan, 2006; Sarkar, 2007; Radnor, 2010; Malladi et al., 2011; Guimarães & De Carvalho, 2012; Kundu & Manohar, 2012; Morrow et al., 2012; Malmbrandt & Ahlstrom, 2013) various enablers were identified as given below:

- Communication
- Knowledge creation
- Knowledge Sharing
- Standardise Best Practices

5.5.9 Servicescapes

Although for researchers interested in service industry; Servicescape is not a new phenomenon but very few researchers considered servicescape as an important initiative. Servicescapes concept was developed by Booms & Bitner (1981) to stress the influence of the physical environment in which a service process takes place. The tangible facets of the service facility, i.e. the man-made physical environment such as equipment, machinery, signage and employee appearance-the ‘servicescape’, strongly influence both employees and customers in physiological, psychological, emotional, sociological and cognitive ways, particularly as the core service becomes more intangible (Sureshchandar et al., 2001). Literature has suggested about the impact of physical setting on customer satisfaction and also on employee satisfaction, motivation and efficiency. Presence of customer as co producer in service process along with simultaneous production and consumption of services made it necessary for the service organisation to provide for the needs of both the stakeholders. The ability of the physical environment to influence behaviours and to create an image is particularly apparent for service businesses such as professional offices, banks, hospitals, hotels, restaurants and retail stores (Kotler, 1973; Booms & Bitner, 1981; Parasuraman et al., 1985; Bitner, 1992; Sureshchandar et al., 2001; Reimer & Kuehn, 2005; Holder & Berndt, 2011).

Study by Bitner (1992) shows how the physical setting can aid or hinder the accomplishment of both internal organizational goals and external marketing goals. He has identified three dimensions of servicescape as ambient conditions (i.e. weather, temperature, air quality, noise, music, odours), spatial layout and functionality (i.e. the way in which equipment and furnishings are arranged) and signs, symbols and art facts. Wakefield & Blodgett(1996) and Arneill & Devlin (2002) have empirically examined the role of the physical environment and ambient conditions like the satisfaction process of services consumers. Bitner (1992) and Nguyen & Leblanc (2002) have talked about signs, symbols etc as visual elements or tangible cues which communicate information about an organisation’s beliefs and its ways of doing things. Various researchers such as Bitner (1992), Lloyd & Ezeh (2008) and Holder & Berndt (2011) have suggested that the physical attractiveness of the service personnel at the interface with customers can greatly enhance the service experience and affects the service quality. (Reimer & Kuehn, 2005) highlighted that the servicescape is not only a cue for the expected service quality, but also influences customers' evaluations of other factors determining perceived service quality. The spatial layout and functionality helps in decreasing the waste of motion and transportation. Signs, symbols etc act as part of visual management along with delivery of right information and education to the customers. This helps in reducing defects and variations in services.

The extensive literature search was done to identify various elements under Servicescapes pillar. Based on the literature (Bitner, 1992; Arneill & Devlin, 2002; Nguyen & Leblanc, 2002; Lloyd & Ezeh, 2008; Rosenbaum & Massiah, 2011) various enablers were identified as given below:

- Ambient Conditions
- Space
- Signs, Symbols & Artefacts

5.5.10 Operational Performance

Lean is a business model that delivers far superior performance for customers, employees, shareholders and society at large. Considering the investment being made it is necessary to measure the progress being made. If you don't measure your organization's Lean transformation, you won't monitor it, and if you don't monitor your organization's lean transformation, you can't manage it. If you don't manage your organization's lean transformation, it will fail (Searcy, 2009). Organisation should measure the performance to evaluate the success of lean transition.

Performance indicators can be categorized into leading real time indicators (mainly operational) and lagging performance indicators (mainly financial) (Fitzgerald et al., 1991). The traditional accounting methods have failed to incorporate the true valuation of an organisation's intangible and intellectual assets (Kaplan & Norton, 1992) which also incorporates high-quality services, knowledge workers, responsive and robust internal processes (Bhasin, 2008) and satisfied and loyal customers . These are more important in present information intensive knowledge era (Womack and Jones, 2005). Traditional financial measures are ill-equipped to portray the effects of process improvements and lag behind operational improvements in lean implementations

(Swank, 2003; Schonberger, 2008; Searcy, 2009) and they largely ignore value creation (Womack & Jones, 2005; Bicheno, 2008).

Thus one needs to have operational measures which complements the financial results and may give early warning system if the results are not as anticipated. Related researches indicate that operational performance measures are connected with adoption of lean. Shah & Ward (2003) in their study of the four bundles; namely JIT, TQM, TPM and HRM found a positive correlation with operational performance. Fullerton & Wempe (2009) determined that the implementation of lean initiatives induces firms to increase their use of Non Financial Measure of Performance (NFMP) measures in order to provide relevant, actionable information to employees working in environments focused on flexibility, quality, and responsiveness. The most commonly cited paybacks in literature are given in table 5-3.

Table 5-3: Operational Performance Measure Recommended by Authors

Waste Reduction	Swank (2003), Apte & Goh (2004) , Comm & Mathaisel (2005), Bortolotti et al. (2009), Staats et al., (2011) , Malmbrandt & Ahlstrom (2013)
Cost Reduction	Apte & Goh (2004), Brandao de Souza (2009) , Piercy & Rich (2009), Bonaccorsi (2011), Malladi et al. (2011), Malmbrandt & Ahlstrom (2013)
Resource Utilisation	Bowen & Youngdahl (1998), Comm & Mathaisel(2003), Swank (2003), Apte & Goh (2004), Bonaccorsi (2011), (Modig & Ahlstrom, 2012)
Quality	Swank (2003), Ahlstrom (2004), Kollberg et al., (2007), Staats et al., (2011) , Díaz et al., (2012), Malmbrandt & Ahlstrom (2013)
Customer Satisfaction	Apte & Goh (2004) , Kollberg et al., (2007), Piercy & Rich (2009), Malmbrandt & Ahlstrom (2013)

It was felt measures of just waste reduction , resource utilisation , quality are not sufficient in itself as organisations are aiming for faster speed of delivery, flexibility in operations and innovations in providing higher value to customers. Hence these measures were also added in the framework.

Performance measures answers the question whether the adoption of lean management has led to real process improvement and improvement in key performance indicators. Operational benefits should be considered before doubting the successfulness of lean service (Hadid & Afshin Mansouri, 2014).There are reasons to argue that a process is not becoming “leaner” if it does not display an improvement in important key performance indicators (Wan & Chen, 2008; Malmbrandt & Ahlstrom, 2013). As services are heterogeneous in nature the definition and measure of operational performance may differ (Malmbrandt & Ahlstrom, 2013). The authors aspire to give general operational measures and services may build up items suited to measure the performance of their specific process.

1. *Waste Reduction:* Lean is elimination of waste or NVA activities in any processes. Hence the first thing one should measure is reduction or elimination of waste in any given service processes. Waste reduction can be measured in terms of reduction in time or reduction in number of defects/errors. Authors like Liker & Morgan (2006), Malladi et al., (2011) and Poppendieck (2002) have given eight wastes in services. The reduction in any or all can lead to achievement of lean. Waste reduction can be improvement in waiting time of customers or patients. It can be reduction in movement of customer or materials or employees for serving the customer or minimising transportation of resources. Reduction in inventory is an important indication of achieving lean; in services the inventory can be claims waiting to be processed, tests waiting to be done, mails waiting to be replied. Slump in these is the measurement of waste reduction. Sector specific reduction in waste can be in for reduction in rework, data re-entering, generating reports no one will read, delayed delivery etc. Poor layout and poor ergonomics also impact service delivery and interaction with customers. Optimum utilisation of people's skill and reduction in number of approvals or signatures required are other example of measure of waste reduction. Lessening in service failures and reduction in defects like number of bugs in software, tests to be redone in hospitals, rework in banks or number of complaints in call centre are another measurement of reduction in wastes. Reduction and elimination of wasteful activities, identification and elimination of the root causes of defects helps lean organizations improve productivity and efficiency

   In nutshell shorter lead time, shorter cycle time, and faster response time are indication of waste reduction.

2. *Costs:* The term costs implied value of money that has been utilised to produce a product or services and which is not available now. Increasing customer demands, competitive pressures and rising operational costs are beginning to force a rethink of

the management of operations in services (Allway & Corbett, 2002). Services are striving to give a better service offering to the customers at lower costs. Many organisations go for staff lay off as a mean of cost reduction but this is not an effective solution in long term. Many Indian service companies have also gone for lowering the price or profits. Again the strategy will not give long term results as the competitors follow the suit. On the other hand price is more a function of law of demand and supply and the market place. Hence one can only improve the profit by reducing cost through improving the processes. Elimination or reduction of waste along with simplifying process leads to reduction in costs (Piercy & Rich, 2009) Sector specific costs reduction can be achieved by controlling the transportation of patients in hospitals , documents in financial services, early feedback of clients, standardisation etc. Sharing of information and best practices also reduces cost as it saves on duplicate effort and leads to learning from others' experiences. Reduced lead time, cycle time and delivery time leads to saving in costs (Chiarini, 2013). Costs can also be controlled by task rotation as absenteeism will not lead to higher costs. Process improvement also reduced labour cost (Swank, 2003). Application of lean thinking to the service context has been suggested as a means to reduce costs and improving quality by various authors (Womack & Jones, 1996; Piercy & Rich, 2009; Apte & Goh, 2004; Malmbrandt & Ahlstrom, 2013). Cost and quality are major means of achieving competitive advantage.

3. *Resource Utilisation:* Lean is about creating more value for customers with fewer resources. Resource can be a stock or supply of men, money, materials and other assets that are required by an organization to function effectively. According to Womack & Jones (1996) lean thinking is lean because it provides the way to do more and more with less and less, less human effort, less equipment, less time and less space. Adoption of lean management leads to half the hours of human effort in the factory, half the defects in the finished product, one-third the hours of engineering effort, half the factory space for the same output and a tenth or less of in-process inventories (Womack et al., 1990). Lean tries to shift the organisational focus in eliminating waste leading to create flow efficiency (Modig & Ahlstrom, 2012) resulting into optimising the resource utilisation. Any resource has three main characteristics of utility, limited availability and potential for consumption. Lean

aims for optimum or balanced utilisation of resources. It improves resource utilisation my removing those activities which absorbs resources but do not add value. VSM act as the best tool for identifying and removal of NVA activities. Thus the relieved resources are incorporated in activities producing value for the customer. As Swank (2003) justified in the case study of Jefferson pilot productivity is doubled with using less space, labour and capital. The adoption of lean will certainly lead to enhancing productivity and efficiency of resources. Resource utilisation is quite important in services; it being a people oriented with rising cost of getting knowledgeable and skilled work force. Apte and Goh (2004) has stressed on measuring labour utilisation as a measure of successful lean implementation. Utilisation can be measured in terms of number of man-hours saved, no of hours devoted to tasks, utilisation of material and machinery. Timely and accurately availability of information is recommended by Apte & Goh (2004) and Kundu & Manahor (2012) as optimum utilisation of information.

4. *Quality:* Quality is fitness of use. In services quality is comparison of expectations with performance. The quality in the service context is a strategic element because it allows gaining competitive advantages, reducing costs and increasing market share and profits (Zeithaml et al., 1988; Bortolotti et al., 2009). It is necessary to measure service quality as it helps in identification of quality related problems, gave an idea about improvements achieved and also helps in establishing standards for service delivery. There are lot of service quality models in literature and the most used model is SERVQUAL; also called as "gap analysis model"; developed by Parasuraman et al., 1985 (Nyeck et al., 2002). In SERVQUAL model Parasuraman et al. (1985) the service quality is reliant on the extent and direction of the five gaps that can be in the service delivery processes. The model measures the five dimensions of service quality reliability, assurance, tangibles, empathy and responsiveness. Reliability refers to the ability to deliver service as promised. Assurance is the ability of an organisation to instil trust and confidence in customers by means of knowledgeable and courteous employees. Tangibles are about the appearance of personnel, equipments, communication material, physical environment and facilities. Empathy is related to the willingness and capability to take personalised interest in customers. Responsiveness is the willingness to give quick and prompt services to customers.

Quality can also be measured percentage of recovery of service failures (Sa´nchez & Pe´rez, 2004). Quality can be enhanced by adopting principle of zero defects and using input of high quality (Malmbrandt & Ahlstrom, 2013). Many service organisation has used lean tool of standardisation to improve service quality so as to reduce variations at multi touch points.

In general improvements in service design and service delivery leads to improvement in service quality. Various techniques like Quality Functional Deployment (QFD) may be used to capture customer requirements and transforming them into service design and delivery. Customer involvement, use of statistical process control, standardising services etc can be used to enhance conformance to quality. A good example is how low frill airlines have improved their turnaround time by involving customers in keeping airplanes clean. Sureshchandar et al.(2002) and Al-Marri et al. (2007) have stated the positive relation between service quality and customer satisfaction, leading to enhancement of one by the other.

5. *Delivery*: Delivery performance is deemed to be fundamental to success of any service organisation. Service delivery is where the service is eventually implemented. The service delivery system should focus on engaging frontline employees to deliver the best customer experience. Lean management helps in optimising service delivery, preventing delays in delivery by targeting wastes. NVA activities can be identified and removed thus improving service delivery. Delivery can also be improved by standardising the services for e.g. Mc Donald's. Within the present era of fast communication and demanding customers delivery doesn't only mean delivery on time but it also includes delivery in terms of agreed quantity, place, speed, convenience and budget of the delivered product or service (Ibrahim, 2010). It deals with the fulfilment of an organisations commitment towards its customers (Phusavat & Kanchana, 2008). It measures the ability of an organisation to keep it promises or contractual agreement (Phusavat & Kanchana, 2008) and its accountability towards its customers. It is the measure of dependability of the organisation. Efficient service delivery extends higher value to customers and leads to higher customer satisfaction. Delivery speed can be measured by reduction in waiting time, cycle time, turnaround time and time taken for settlement of customers' complaints or requirements.

6. *Flexibility*: Flexibility is central to respond to demand uncertainty and intense competition. It is the ability to adapt to new, different or changing requirements .The term flexibility represents the capability to deploy and/or re-deploy resources in response to changes in environment. Such operational flexibility comprises of several different dimensions including service (or mix) flexibility, volume flexibility, new service flexibility, process flexibility etc. It is essential to plan and manage the whole system flexibility and not only a particular dimension to gain competitive advantage. In services flexibility is paramount due to customer involvement which needs certain level of customisation i.e. changing from one customer needs to another. Flexibility in services involves the introduction of new designs and services into the service delivery system quickly, adjust capacity rapidly, customize services, handle changes in the service mix quickly and handle variations in customer delivery schedules (Suarez et al., 1996(Sa´nchez & Pe´rez, 2004) has advocated use of multifunctional teams as way of achiveing functional flexibility. When analysing this relationship, traditional cost performance measures lack relevance in the service environment, as they do not reflect the customer-focus factors of quality, flexibility or satisfaction, which have become crucial to firm success (Neely et al., 1997). Flexibility is the need of the hour; processes need to be more versatile, giving desired value to the customer maintaining the quality of service while controlling the costs.

7. *Customer Satisfaction:* This term indicated on the knowledge on customers and how to utilize this knowledge for fulfilling customer expectation (Sink & Tuttle, 1989). Farris, et al. (p. 57, 2010) defines customer satisfaction as "the number of customers, or percentage of total customers, whose reported experience with a firm, its products, or its services (ratings) exceeds specified satisfaction goals”. Customer satisfaction measurement has a significant role in apprising service improvement. It enables an organisaton to understand what its customers value the foundation of lean management, how values vary between different customers, and where the actions should be taken to improve service delivery. Customer satisfaction with a service is influenced significantly by the customer’s evaluation of service features and perceptions of equity and emotional responses (Zeithaml & Bitner, 2003). The philosophy of customer coming first, the importance of relationships and values will

certainly leads to continuing profits and sales. Customer satisfaction is a major factor in any business strategy and acts as a key differentiator in competition advantage. Customer satisfaction measurement internally sends the signal about importance of customer and that they should have positive experience. On the other hand, it gives an indication of how well the expectations have been met and intention of the customer to return back.

Lean fundamentally revolves around customer by aiming for providing what is the “value” for customer at every stage. It aims to retain only those activities which add certain value towards meeting customer requirements. Thus Lean is basically an exercise in enhancing customer satisfaction. Measurement of customer satisfaction is another measure of Lean being successfully implemented in organisation. Focusing on your customer needs via the lean methodology will ensure that quality and customer satisfaction always remain high giving one the competitive edge. It can be measured by reduction in customers’ complaints, customer satisfaction score, customer loyalty etc.

8. *Innovation:* Innovation is a new idea or more effective solution for fulfilling existing or new customer requirements impacting the society at large and having some economic value. Innovation has been positively linked to efficiency, productivity, quality, competitiveness and market share. As Davila et al. (2012) notes, "Companies cannot grow through cost reduction and reengineering alone. Innovation is the key element in providing aggressive top-line growth and for increasing bottom-line results".

   Van Ark et al., (2003) has defined Service Innovation as "a new or considerably changed service concept, client interaction channel, service delivery system or technological concept that individually, but most likely in combination, leads to one or more (re)new(ed) service functions that are new to the firm and do change the service/good offered on the market and do require structurally new technological, human or organizational capabilities of the service organization.”

   In services it is important to manage the result of service processes along with customer experience. As a consequence more and faster innovation in service businesses is required and need to be implemented in service business models and business process (Sellitto et al., 2003). Innovations in services take place in multiple forms using information technology, knowledge management using investment in research and development along with employees' trainings. The market situation, customers and competitors play a major role in inception of innovation (Sundbo, 1997). Ideas for innovations should come from all parts of the organisation and the external networks can also contribute towards it. Innovation in long run is just like organisational learning contributing towards the growth of employees and organisation improving its potential for meeting future market situations. The only challenging area is that Service innovations can be easily imitated hence are difficult to be protected.

5.5.11 Business Performance

Lean management has also been recognized as an incredible strategy to improve business performance (BP) as lean aims to deliver right items, in right quantities, at right time and at right place (Nawanir et al., 2013). Business performances have been defined as the extent of outcome results of fulfilling market and financial goals (Narasimhan & Kim, 2002; Menor et al., 2007). There has been almost no meticulous research examining the link between Lean Practices, Operational Performance and Business Performance in services. Though in manufacturing authors have strived to establish relationship between lean manufacturing and performance outcomes. The most commonly cited business performance measures in lean literature are given in table 5-4.

Table 5-4: Business Performance Measures Recommended by Authors

Profit	Ahmad et al., (2003), Bhasin (2008) , Fullerton & Wempe (2009), Nawanir et al., (2013)
Sales	Narasimhan & Kim (2002), Kannan & Tan (2005), Green & Inman, (2007), Bhasin (2008) , Hong, et al. (2014)
Customer Base	Sakakibara et al., (1997), Green & Inman (2007), Bhasin (2008) , Nawanir et al., (2013)
Market Share	Narasimhan & Kim (2002), Menor, et al. (2007), Hong et al. (2014)

The literature had mixed results regarding the relationship between lean practices and performance measures. Fullerton & Wempe (2009) have empirically proven that utilization of Non-Financial Manufacturing Performances (NFMP) measures mediates the relationship between lean manufacturing and financial performance. Alsmadi et al.

(2012) has conducted survey on both UK Manufacturing and service organisation to study the lean-performance relationships showing positive outcome. Authors have used a limited number (ten) of lean practices where employing a larger set of practices will provide a clearer picture on the lean-performance relationship. Nawanir, et al. (2013) in their study of Indonesian manufacturing companies determined that Lean practices have a positive and significant impact on both operational performance and business performance. Hong et al., (2014) have theorised and using survey methodology have justified that performance outcomes are indirectly influenced through the combined efforts of technical and human lean manufacturing practices. In services drawing on the universal theory, socio-technical systems theory and contingency theory (CT), Hadid & Mansouri (2014) have clarified the potential impact of lean service on operational and financial performance. The findings suggested that social bundles of lean service had an independent positive impact on firm operational and financial performance. While the technical bundles of lean services had positive effect only on the operational performance and not on business performance.

Operational Performance is believed to have a positive relationship with business performance (Stede et al., 2006; Nawanir et al., 2013) because removal of waste or non-value added activity at process level would enhance the profitability, sales, market share and customer base. Said et al., (2003) maintains that non-financial performance measures provide a means of transforming a firm’s strategy and vision into a tool that motivates performance and communicates strategic intent. Fisher (1992) contends that firms tracking key success factors through non-financial performance measures have superior financial results. According to Fullerton & Wempe (2009) success of the companies with respect to overall performance is sufficiently determined by the success at the operations level. Authors believed that tracking, reporting, and analysing operational performance measures provides vital feedback and that improvement in operational performance lead to enhancement of financial performance too. Losonci & Demeter (2013) findings suggest empirical results regarding improvements in business performance of lean companies are ambiguous. The results suggested that lean production, in spite of operational excellence, does not improve business measures. The analysis of study stated that there are many factors impacting business performance apart from operations like market dynamics, intensity of competition, new entrants etc. which are beyond the scope of operations management.

Most of the studies in literature have identified the impact of lean on business performance in developed economy (Nawanir et al., 2013). The researchers believe that researches have to be done in area of Lean Services and its impact on performance along with emphasis developing economy.

This research will add to it as the researchers have also included lean enablers as part of the framework to make it more comprehensive. Enablers are capabilities or forces which contribute positively towards the success of any project or methodology. Enablers like Top Management Commitment, HR and Change Management, IT and Knowledge Management and Servicescapes are necessary for successful and sustainable implementation of lean along with Lean Practices of elimination of waste with an aim towards continuous improvement. The amalgamation of the above theories led to the development of structural framework and hypothesis development as discussed in next section.

5.6 Structural Framework and Hypothesis

Structural framework is as depicted below.

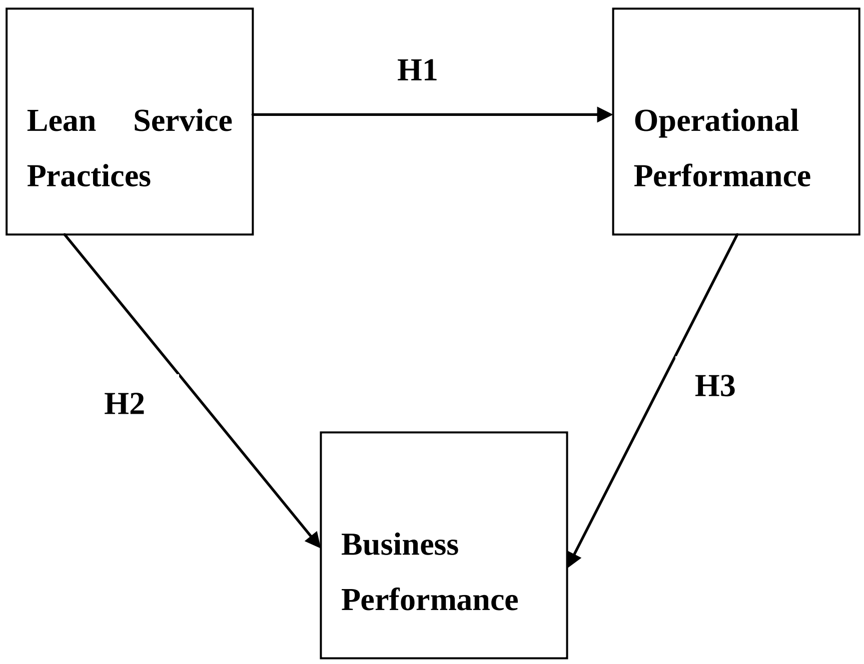


Figure 5-2: Structural Framework

The study aims to test the set of hypotheses to analyze the relationship between identified Lean service practices, operational performance and business performance in Indian Services. Literature review supports the above view. This leads to the following main hypothesis:

H1. There is a significant positive relationship between identified Lean Service practices and operational performance of Indian service companies.
H2. There is a significant positive relationship between identified Lean Service practices and business performance of Indian service companies.
H3: There is positive relationship between operational performance and business performance.

This leads to the following specific hypotheses:
H1a: Top management commitment in an organisation is positively associated with operational performance.

H1b: HR &change management in an organisation is positively associated with operational performance.

H1c: Customer relationship management in an organisation is positively associated with operational performance.

H1d: Elimination of waste in an organisation is positively associated with operational performance.

H1e: Continuous Process Improvement in an organisation is positively associated with operational performance.

H1f: Supplier relationship management in an organisation is positively associated with operational performance.

H1g: Information and Technology management in an organisation is positively associated with operational performance.

H1h: Knowledge management in an organisation is positively associated with operational performance.

H1i: Servicescapes in an organisation is positively associated with operational performance.

H2a: Lean service practices are positively associated with annual sales turnover.

H2b: Lean service practices are positively associated with market share.

H2c: Lean service practices are positively associated with profits.

H2d: Lean service practices are positively associated with customer base.

H3a: Operational Performance is positively associated with sales turnover.

H3b: Operational Performance is positively associated with market share.

H3c: Operational Performance is positively associated with profits.

H3d: Operational Performance is positively associated with customer base.

5.7 Conclusion

Various lean service frameworks as proposed by different researchers and practitioners were reviewed to find out the common elements. This chapter aim was to identify the common elements and add to it some more essential elements to provide a comprehensive framework. As a result around 47 elements were identified and were placed under major initiatives like Top Management Commitment, Human Resource Management, Customer Relationship Management, Elimination of Waste, Continuous Process Improvement and Supplier Management. Along with the same some more initiatives like Change Management, Servicescapes, Knowledge management and were proposed keeping into account the changing business scenario.

Change management in form of structured processes and set of tools is essential to prevent unintended negative outcomes of any change methodology. Servicescape can act as image differentiation in market giving competitive edge. Considering the current era of information technology and many services being considered as knowledge work they were included as important elements. Information Technology has become backbone for running any business including services. Similarly knowledge management has become essentials to reduce the learning curve leading to cost reduction and improving responsiveness.

Lean involves operational practices that are useful to achieve enhanced performances in terms of quality, delivery, flexibility, resource utilisation, cost saving, innovation and waste elimination. These operational performances in turn affect the business performance enabling the organisation to be competitive, to give better customer service and enhance the company growth. The company growth can be measured in terms of sales, market share, growth in customer base and profitability.

Further various items/sub elements for the main initiatives/elements of lean services can be further analysed through survey of the Indian Service Industry. The reliability of the framework shall be empirically tested through questionnaire survey.

CHAPTER 6: EMPIRICAL INVESTIGATION OF PROPOSED LEAN SERVICE FRAMEWORK IN INDIAN SERVICE INDUSTRY

6.1 Introduction

A framework for lean services was developed in the previous chapter. Nine main pillars were identified, along with the various elements under each pillar. A nationwide exploratory cross sectional survey was conducted to check the reliability, validity and applicability of the proposed framework. The details of the same are presented in subsequent sections.

6.2 Methodology for Empirical Investigation

The methodology discussed in chapter three was followed to conduct the empirical investigation in the second stage. The description about the same is discussed below:

6.2.1 Theory Verification

The first step in systematic empirical study is the verification of the theory. New framework has been proposed which contains lean elements majorly considered in literature along with new lean elements like knowledge management and servicescape which were not considered by other researchers. To validate the proposed framework it was empirically investigated in Indian Services.

6.2.2 Research Design

Nationwide cross sectional survey was administered to empirical investigate the proposed lean service framework in Indian service industry. The survey instrument was developed by identifying suitable elements as discussed in chapter five.

Each pillar /construct was measured using multi items measure. The multi item measure improves the reliability, reduces measurement errors and leads to greater variability amongst respondents and improves validity (Churchill Jr., 1979). Each construct was measured using at least three items for effective measurement and analysis (Gerbing & Anderson, 1988).

A pre-test of proposed survey questionnaire was conducted with eight academics and seven business professionals followed by personal discussions. It was assured that all pre-test personnel consulted had the knowledge required to improve the quality of our measurement. The academicians consulted had been working in the field of lean services. They have undertaken quality research in the field of lean management. Also, business professionals were quality professionals working at senior level or senior consultants working in area of lean. Each participant was asked to evaluate the questionnaire for readability, ambiguity, understanding and appropriateness of each element in relevance to Indian Services and lean. Based on responses and discussion questionnaire was modified, where necessary. As for e.g. initially the instrument had around 66 elements under various lean pillars. Seeing the length of the questionnaire as major hurdle in filling up the questionnaire, help was taken of experts in reducing the number of items in questionnaire though covering all the lean initiatives as defined in section 5.1 as identified. The aim was to confirm that the questions were specific enough to convey clear meaning to survey respondents and not ambiguous or difficult to answer. The survey instrument was developed for assessing level of involvement, agreement or implementation related to various items/elements under each pillar.

6.2.3 Data Collection Method

Cross sectional questionnaire survey, was used to collect the data. Data was collected using stratified purposive sampling. The four service sectors chosen were banking/financial services, healthcare, IT/ITES and telecom as discussed in chapter three. Obtaining adequate and good quality of data in a survey research entails the selection of respondents as very important. The respondents are expected to have appropriate knowledge on the subject areas of the survey. It was considered necessary that respondents must have experience in lean services practices, as well as have general understanding of lean practices and performance measures in their respective organisation. The targeted respondents of the study were lean/quality practitioners along with lean experts (consultants and academicians) working in area of lean services in the chosen four strata.

6.2.4 Implementation

The survey was designed using Google docs and the link of the same was send through emails to the targeted respondents. The questionnaire contained two sections A and B. Section A is aimed to build the profile of the respondent and the service organisation based on the demographic information of the respondent, turnover of the company, number of employees, lean practices pursued and other relevant information. Section B is the structured questionnaire developed on five point likert scale (details given in Appendix II) for assessing the level of involvement, agreement or implementation of each item/element under nine pillars of lean services. A total of 47 items captured the 9 lean practices under investigation. 8 items captured the operational performance while 4 items were used to capture business performance. For each element, 1 was given the lowest weightage meaning very low level of implementation and 5 was given the highest weightage meaning very high level of implementation. Respondents were requested to rate the level of implementation of each element under each pillar of lean practices as an enabler to achieve lean in their organisation with reference to the five point response scale. A typical example is shown below:

Continuous Process Improvement

Kindly rate the level of implementation of following CONTINUOUS PROCESS IMPROVEMENT practices as an enabler to achieve Lean in your organisation.		**Very Low ⟷ Very High**				
CPI 1	Conducting periodic meetings to discuss continuous improvement and lean assessment	1	2	3	4	5

The survey link was accompanied with a cover letter detailing the purpose of the study, general information about the research work and how to fill the questionnaire. The respondents were assured of confidentiality of the responses and were welcome to share any information regarding lean practices in Indian services. Respondents were asked to consider each pillar as an enabler to achieve lean in their organisation with each item in it as a measure or a guide to the organisation wanting to implement/appraise the level of that specific pillar in their organisation. Although the language in the questionnaire was simple and easily comprehensible, the respondents were asked to contact the researcher through email or phone in case of any queries. The survey instrument was administered to 1214 (identified using LinkedIn database) respondents. Subsequently more than 1000 email reminders were sent. Some of the respondents were personally contacted by personal visits or phone calls. 309 responses were received having the response rate of 25.4%. Seven responses were incomplete and four responses were invalid hence 298 valid and complete responses were received. Mahalanobis distances of predicted variables were used to detect multivariate outliers (Cohen et al., 2013; Dubey et al., 2015). 12 outliers were detected leaving valid responses to 286 yielding a response rate of 23.3% which is well within the range of 85-300 cases as recommended by Hair et al., (2006), Kureshi et al., (2010) and Talib et al., (2013) for multivariate data analysis. Statistics of sector wise responses are shown in Table 6-1 & Figure 6-1. The percentage of responses received from each sector is in line with percentage of survey instruments floated in different sectors. Table 6-2 and figure 6-2 shows sector wise responses of consultants.

Table 6-1: Statistics of Sector Wise Response

Sector	Frequency	Percentage	Cumulative Percentage	Sample size	Sample Proportion
Banking/Financial	49	17	17	256	21
Healthcare	34	12	29	102	09
IT/ITES	114	40	69	595	49
Telecom	34	12	81	97	08
Consultant	55	19	100	164	13

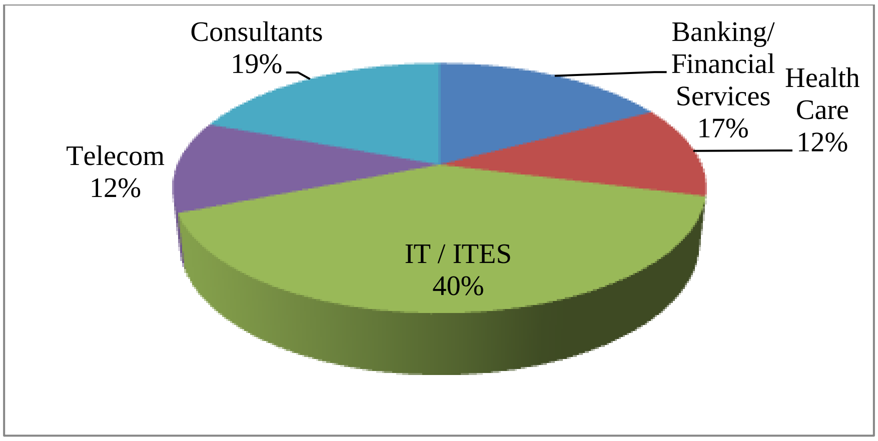


Figure 6-1: Statistics of Sector Wise Responses

Table 6-2: Sector Wise Responses from Consultants

Sector	Frequency	Percentage	Cumulative Percentage
Banking/Financial	36	31	31
Healthcare	25	22	53
IT/ITES	35	31	84
Telecom	18	16	100

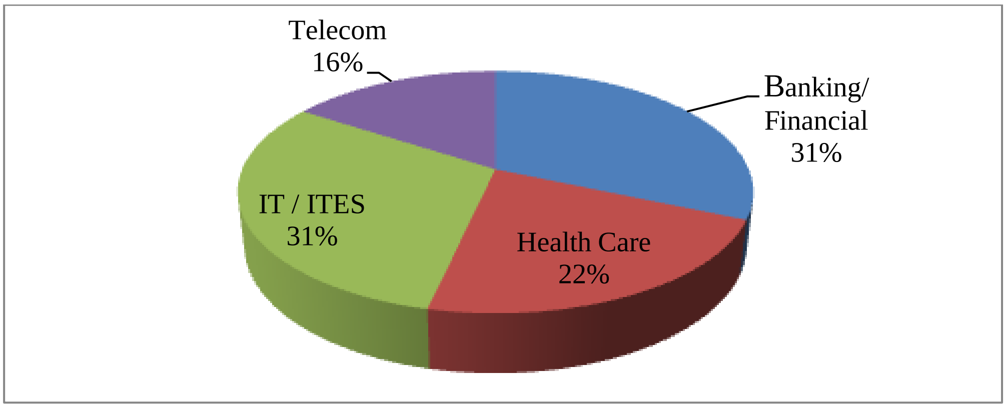


Figure 6-2: Sector Wise Responses from Consultants

6.2.4.1 Status of Lean in Indian Services

The focus of section A was to look at the number of employees, position occupied by the respondents in the organisation, total experience and experience in lean. The company variables consisted of number of employees (different range for industry and consultants), annual sales turnover (different range for industry and consultants), quality initiatives adopted, key objectives for adopting lean (ranking) and lean practices adopted as depicted in figures below. The respondents from industry were mainly CEO, Founders, Promoters, VP, AVP, Director, Heads, Business Excellence Managers, GM, Project Managers, and Quality Managers.

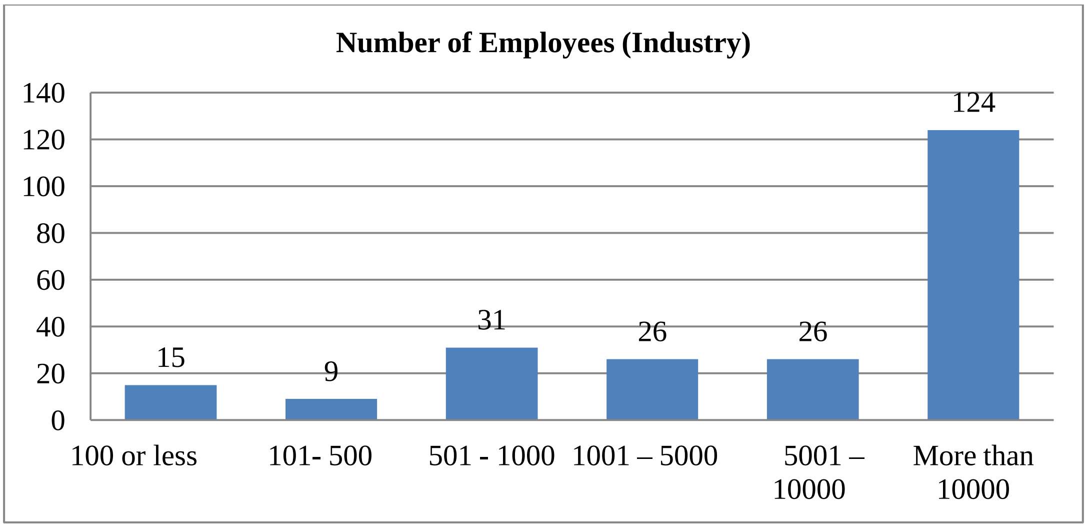


Figure 6-3: Number of Employees (Industry)

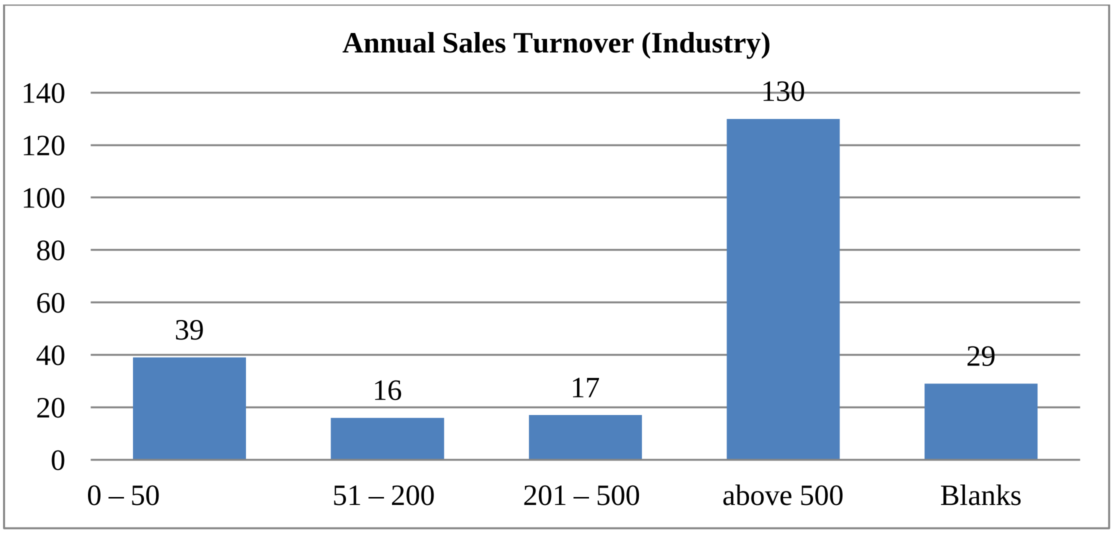


Figure 6-4: Annual Sales Turnover in Crore Rs. (Industry)

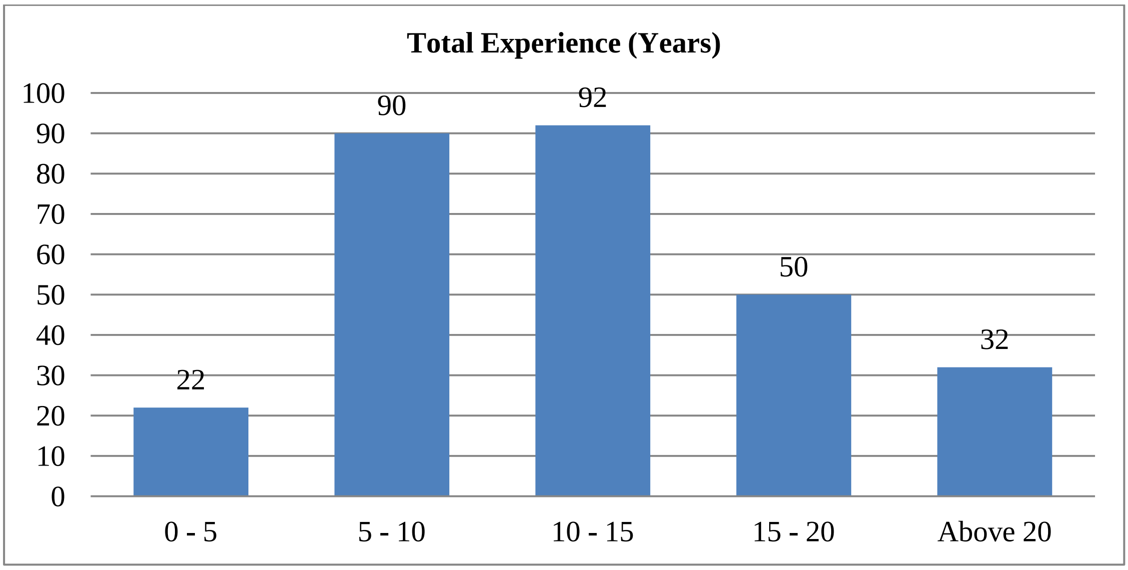


Figure 6-5: Experience of Respondents

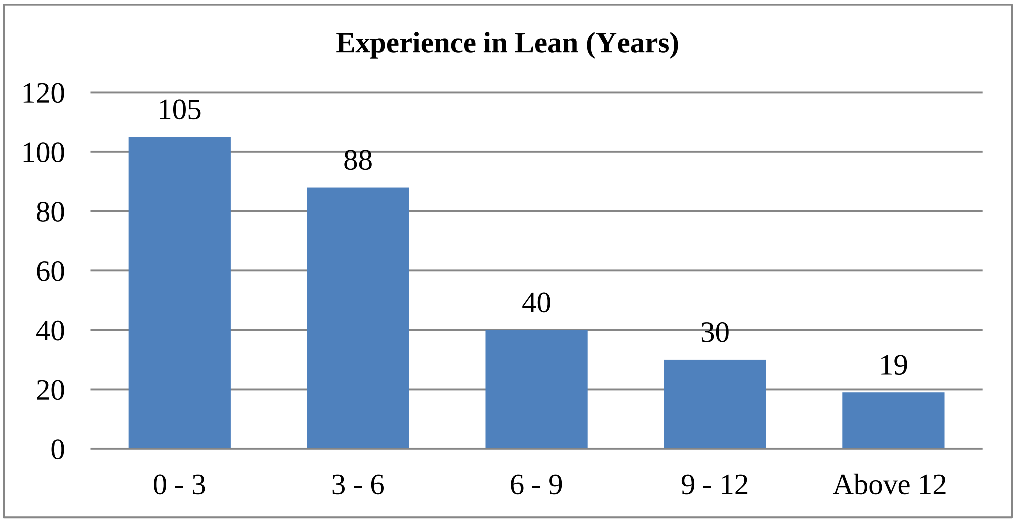


Figure 6-6: Experience of Respondents in Lean

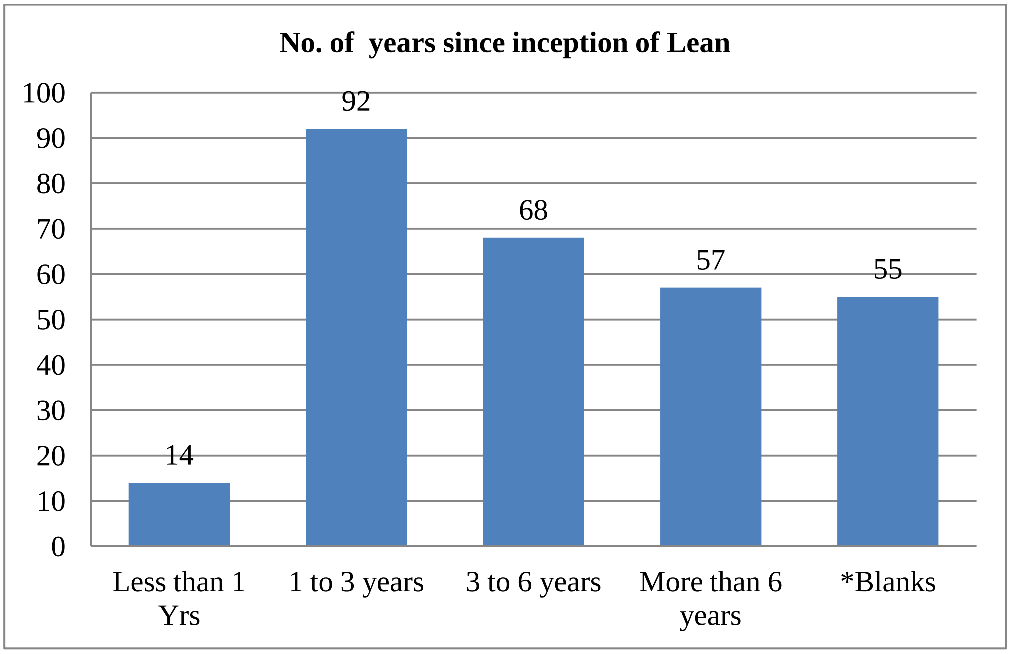


Figure 6-7: No. of years since inception of Lean

*Consultants were not asked hence their blank response

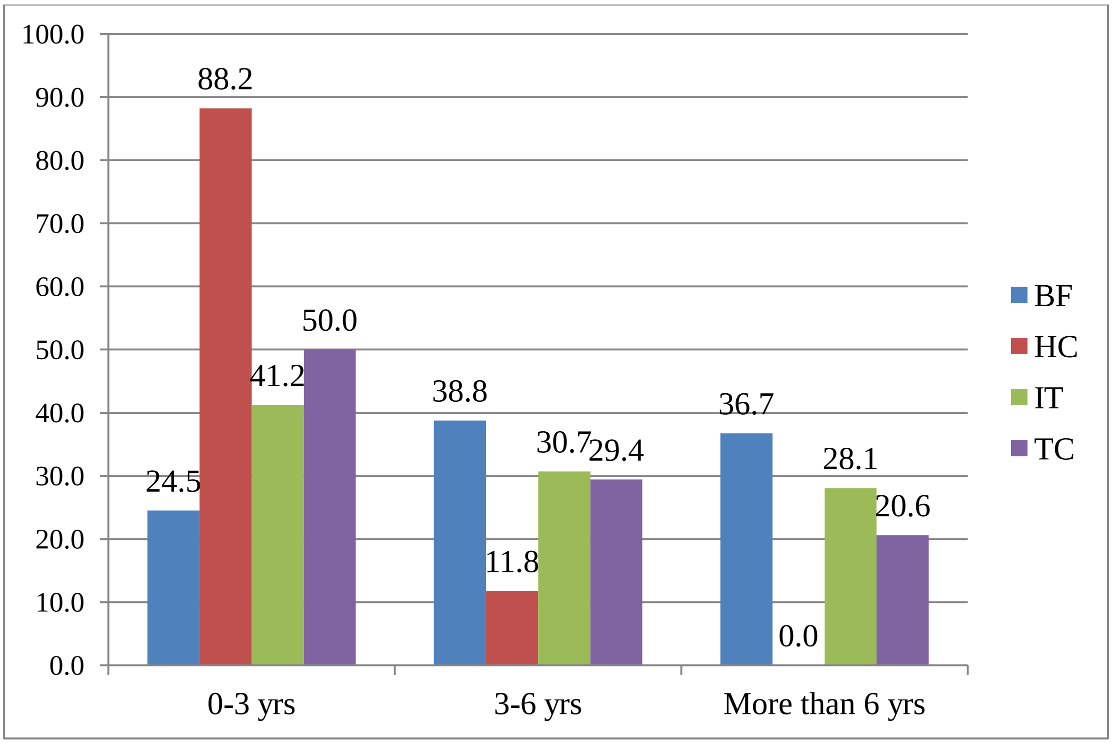


Figure 6-8: No. of Yrs since Inception of Lean (Sector Wise in Percentage)

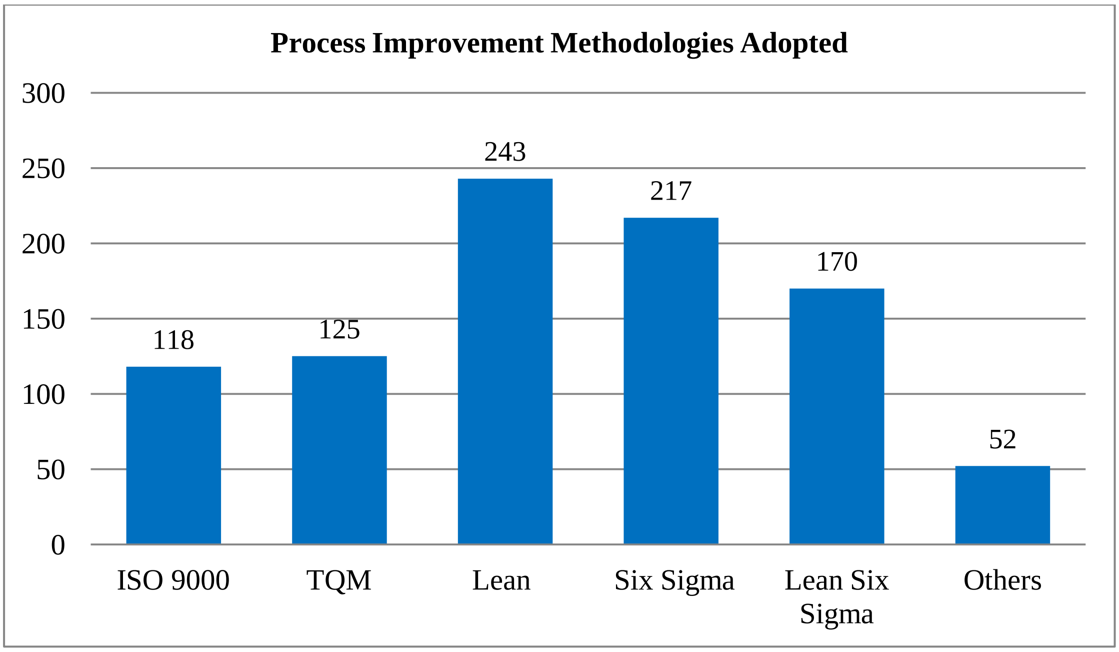


Figure 6-9: Process Improvement Methodologies adopted

Table 6-3: Key objective/s for implementing the process improvement methodology (Rank wise)

	Minimum	Maximum	Mean	Std.	Ranking
Enhance Operational Excellence	1	8	2.69	1.984	1
Improve Service Quality	1	8	2.72	1.388	2
Improve Customer Satisfaction	1	8	2.89	1.603	3
Reduce cost	1	8	4.85	1.867	4
Improve Net Income	1	8	5.10	2.205	5
Solve chronic problem	1	8	5.28	1.694	6
Competitive in Global Market	1	8	5.70	2.054	7
Better image	1	8	5.93	2.291	8

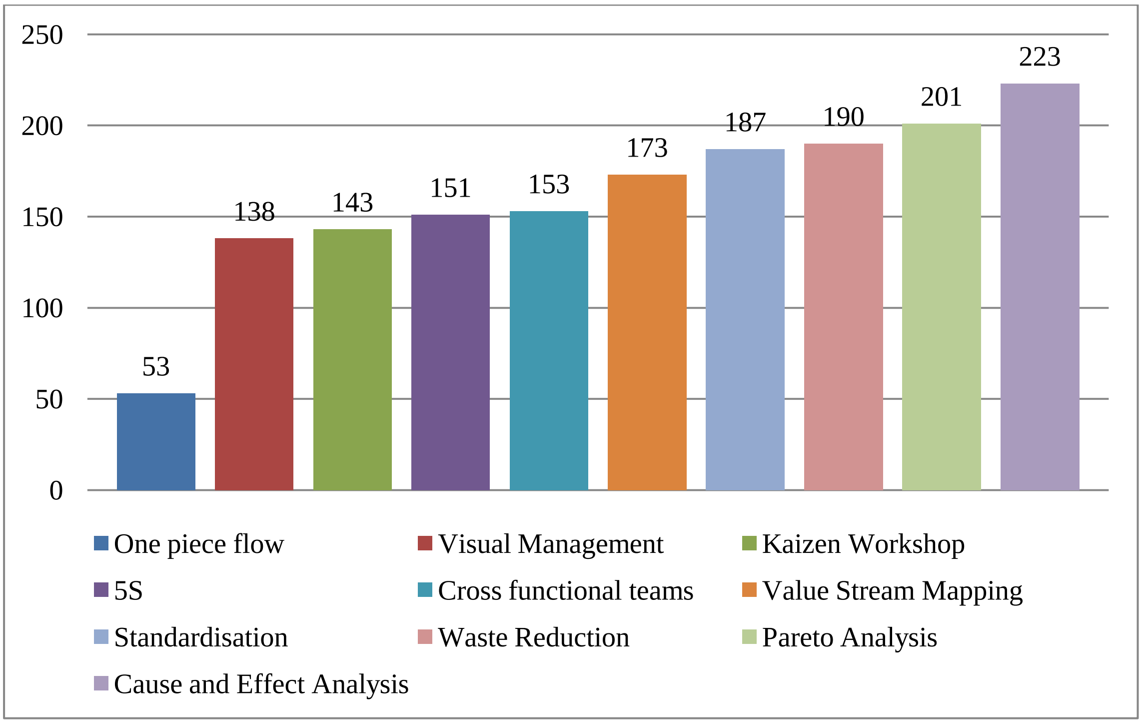


Figure 6-10: Lean Practices Implemented

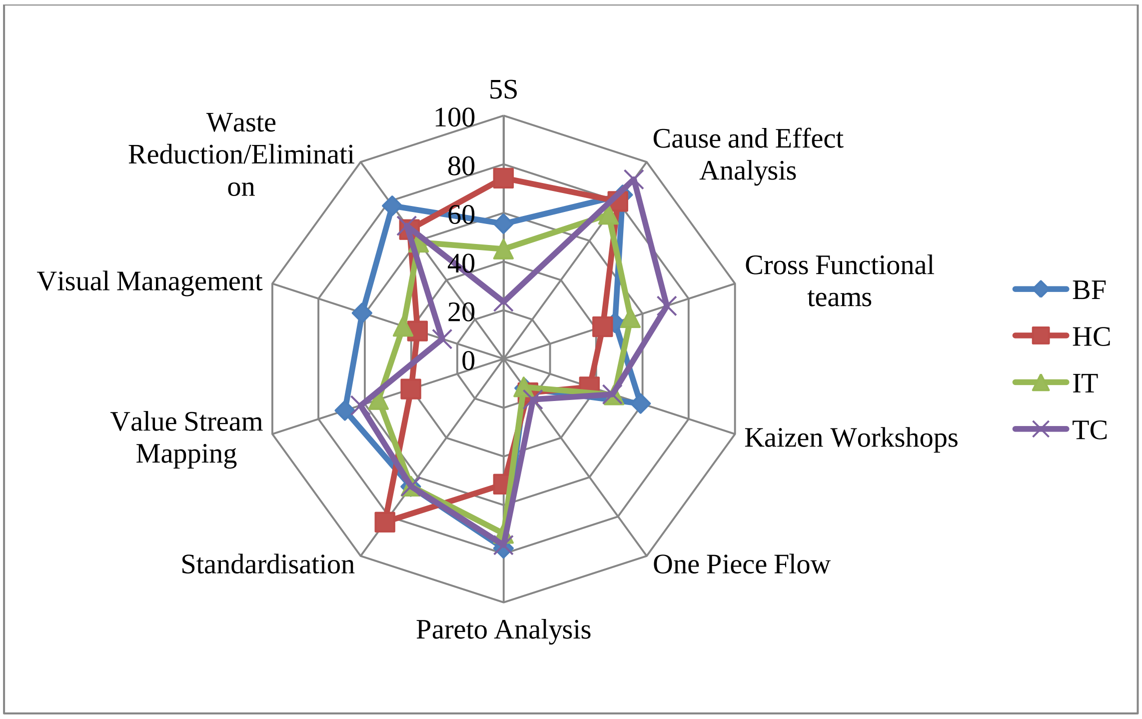


Figure 6-11: Sector Wise Lean Practices Implemented

Organisation's size is presented in terms of a number of employees in the company. 53% of the respondents from the industry belong to large size organisation having employees more than 10000 (fig 6-3). Greater part of the respondents of industry are having annual turnover of more than Rs 500 crores (fig 6-4) showing lean had made inroads in larger corporations or multinational companies. The reason might be easier paying capacity leading to access to lean experts. Secondly, achieving operational excellence and improving quality is need of the hour rather than a choice as they are catering to transnational population. On an average the respondents were experienced people, having substantial knowledge in their area of expertise as majority (182) of them were having 5 to 15 years of experience (fig 6-5). Majorly respondents were having experience of 1 to 6 years in lean (fig 6-6). This shows that lean in Indian services is at nascent stage. This can also be verified from years since inception of lean as majority of organisation (92) have adopted lean three years to a year back (fig 6-7). Health care is at budding stage of lean adoption with 88% of respondents implementing lean in last 3years (fig. 6-8). The surge towards quality in health care started since establishment of NABH (National Accreditation Board for Hospitals and Health care service providers) in 2006 in health care. Thus recently the healthcare had become active in implementing process improvement methodology. Telecom and IT/ITES have 50% and 42% of respondents in the bracket of 0-3 yrs and around 30% of respondents in bracket of 3-6 years. Thus major chunk of these sector are also in nascent stage, while few are in growth stage. Banking/Financial services are almost evenly divided with 39% respondents in bracket of 3-6 yrs and 37% in bracket of more than 6 years. This sector can be said in mature stage. Most of the respondents in this sector belonged to private sector MNC bank; who have adopted quality policy of their parent organisation. With advent of MNC’s and FDI in this sector with liberalisation, this sector was quicker in adopting global best practices of process improvements.

Among the prevalent process improvement methodologies like TQM, Six Sigma, Lean etc Lean and Lean Six Sigma are the preferred choice (fig 6-9). This may be due to ease of learning of lean practices and low cost of implementation. Table 6-3 presents the reasons for employing lean methodology. It is apparent from the table that Indian services are well aware of the fact that lean is one of the most useful methodology to enhance overall operational excellence. Key initiatives for implementing process improvement methodologies are enhancing operational excellence, service quality and customer satisfaction. This clearly depicts that Indian service have moved from the narrow mindset of only being cost conscious. The competitive market, sustaining in the same, entering of multinationals along with knowledgeable and demanding customers are forcing the service industry to strive for excellence by improving processes leading to better service quality and satisfied customers.

Fig 6-10 indicates the lean practices being used by Indian services. 223 respondents vouching for cause and effect analysis and 201 for Pareto analysis clearly shows that industry is interested in long term solution eliminating the root cause of problematic area and not going for short term myopic view. Techniques like VSM, Standardisation, and Waste reduction are enjoying the high level of adoption as seen in manufacturing counterpart. Sector wise comparison indicates use of standardisation and 5S is higher in health care (fig 6-11). As these practices are the foundations of lean and healthcare being at budding stage of lean adoption, hence their use is higher in healthcare. After the foundation practices of 5S and standardisation the next step is VSM. It helps in visualising the entire service process and identifying the waste and its sources. Thus the practice of VSM is being adopted extensively by Banking/Financial services which are in the growth stage and also by other sectors. One piece flow was not very popular among the respondents. In services it is difficult to control WIP as many times it's the people who are in waiting, thus making it mandatory to adopt queue and not go for one piece flow.

6.2.4.2 Analysing the Operational Performance Sector Wise

The overall and sector wise mean and standard deviation of operational performance are depicted in table 6-4. The respondents were asked to rate the change in their organisational operational performance after the inception of lean practices on five point likert scale. The highest mean for Banking and financial sector is of quality followed by resource utilisation and delivery. Thus one can deduce lean implementation in banking and financial has impacted quality of services the most followed by improvement in resource utilisation and service delivery. For health care sector, highest mean score is for customer satisfaction followed by quality and delivery. Thus one can conclude lean implementation in healthcare has enhanced customer satisfaction, service quality and delivery of services. The highest means score for IT/ITES sector is of quality followed by customer satisfaction and resource utilisation. It can be inferred lean implementation in IT/ITES has enhanced service quality, customer satisfaction and resource utilisation. For telecom the impact is more on customer satisfaction followed by delivery and quality. It can be inferred lean implementation in Telecom has enhanced service quality, delivery and quality. Overall the mean score is highest for quality followed by delivery and customer satisfaction. Hence it can be deduced that as said in literature lean practices leads to improvement in service quality, resource utilisation, speeds up delivery leading to higher customer satisfaction. Sector wise comparison of operational performances is presented in figure 6-12.

Though lean implementation is at nascent stage in Indian Service Industry but the benefits achieved by the few service organisations can be seen in the form of improved operational performances. As promised lean management leads to enhanced customer satisfaction as it listens to voice of customer. Secondly, as seen in various case studies in literature process improvement using lean practices has improved resources utilisation and delivery by removing NVA activities in process. Thus one can conclude Indian Services are on right path of lean implementation to enhance their performances**.**

Table 6-4: Sector Specific mean for Operational Performance

Operational Performances	**Banking and Financial**		**Health Care**		**IT/ITES**		**Telecom**		**Over all**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Waste Reduction	3.875	0.871	3.838	0.829	3.615	0.789	3.708	0.77	3.81	0.813
Cost Reduction	3.873	0.759	3.762	0.958	3.682	0.886	3.569	0.917	3.80	0.858
Resource Utilisation	3.945	0.853	3.681	0.895	3.732	0.843	3.792	0.729	3.84	0.835
Quality	**4.187**	0.64	4.02	0.774	**3.84**	0.758	3.798	0.913	**4.01**	0.772
Delivery	3.944	0.809	3.969	0.815	3.79	0.843	3.801	1.038	3.95	0.859
Flexibility	3.716	0.831	3.735	0.938	3.475	0.982	3.679	0.781	3.74	0.935
Customer Satisfaction	3.804	0.841	**4.126**	0.787	3.798	0.755	**3.878**	0.717	3.94	0.77
Innovation	3.875	0.85	3.313	0.893	3.583	0.985	3.739	0.869	3.72	0.925

*figures in bold represent the most impacted operational performance after inception of lean practices in that sector

Figure 6-12: Sector wise mean for operational performances

6.2.5 Overview of Data Analysis Techniques

The various data analysis techniques used are as follows:

Descriptive Statistics: Descriptive statistics is the phrase given to the analysis of data that quantitatively describe, present or summarize data in a useful and meaningful way. It describes the basic feature of data under study. There are two general types of statistic that are used to describe data central tendency and measures of spread. Measures of central tendency include the mean, median and mode, while measures of variability include the standard deviation (or variance), the minimum and maximum values of the variables, kurtosis and skewness. This may either provides the initial description of the data which acts as a part of a more extensive statistical analysis, or it may be suffice in itself for a particular investigation.

Reliability Analysis: It measures the overall consistency of the items that are used to define a scale. It addresses the issue that whether the survey instrument developed will produce the same result if it is administered to the same person under same settings disregarding of who administers it. Reliability analysis or scale reliability is checked for each pillar or the construct of the survey instrument. The measurement of scale reliability is based on the correlations between the individual items or elements that make up the scale, relative to the variances of the items. Various kinds of reliability coefficients, with values ranging between 0.00 (not reliable) and 1.00 (highly reliable), are generally used to signify the reliability of the scale. It includes test retest method, alternative forms, split-halves and internal consistency method. Of all the methods the first three have major limitations like two independent administrations of the instrument on the same group of respondents or requiring two alternate forms of the measuring instrument. In comparison, the internal consistency method requires only one administration and is most usually used and effective method (Sureshchandar et al., 2001). Thus it works quite well in field studies. Thus reliability is measured as the internal consistency, which is the degree to which items in the set are homogeneous. Internal consistency can be estimated using reliability coefficient, such as Cronbach's alpha (Flynn et al., 1990; Nunnallly, 1978). The minimum generally acceptable value of Cronbach alpha is 0.70. The Cronbach's alpha of constructs discussed in this study is above 0.70.

Correlation Analysis: Correlation analysis is performed to assess the association/relationship between two constructs. It is designated as Pearson correlation coefficient "r" and it varies between -1 to + 1. It is the measure of the strength of the interrelationship between two variables and whether the relationship is positive or negative. Strength of the relationship is the variance between 0 and 1 whereas sign "-""+" shows the direction of relationship. The "r" describes the extent to which an increase or decrease in one variable leads to corresponding increase or decrease in the other. As a rule of thumb, the following guidelines on strength of relationship are often followed:

Value of r	**Strength of relationship**
-1.0 to -0.5 or 1.0 to 0.5	Strong
-0.5 to -0.3 or 0.3 to 0.5	Moderate
-0.3 to -0.1 or 0.1 to 0.3	Weak
-0.1 to 0.1	None or very weak

A high, or strong, correlation means that two variables have a strong relationship with each other, while a weak, or low, correlation means that the variables are hardly related. A Pearson's correlation analysis was carried out in the research study to examine the bivariate relationships among the main variables and to check the presence of multicollinearity problem.

Validity Analysis: The validity of a survey instrument or measurement tool is the degree to which the instrument measures what it claims to measure. The validity can be considered as equivalent to accuracy. Validity is also dependent on the measurement measuring what it was designed to measure, and not something else instead (Kramer et al., 2014). There are different types of validity.

Face Validity: Face validity is the extent to which an instrument or test is intrinsically considered as covering the concept it aims to measure. It is an estimate whether at face that a variable is valid. Face validity is the subjective assessment of the correspondence between the individual items and the concept through rating by expert (Hair et al., 2006). The researchers rely on their judgement for the process of identifying and selecting the constructs.

In the present study extensive literature review and experts inputs helped in arriving at useful measures of lean services. Based on this the nine lean service practices in our model were judged to have high degree of face validity.

Content Validity: Content validity of an instrument refers to the degree to which it provides a fair representation of the conceptual domain that it is designed to cover (Hair et al., 2006). If the items depicting the various constructs of an instrument are verified by a comprehensive review of the relevant literature, content validity can be ensured (Bohrnstedt, 1983). It is also a subjective measure of how appropriate the items seem to various experts of the subject matter (Saraph et al., 1989; Flynn et al., 1990; Talib et al., 2013).

In the present study, the majority of scales/items used in this study are taken from established scales (after extensive literature review) that have already been subjected to face and content validity checks. Hence nine lean service practices for measuring lean services implementation have face and content validity. Moreover, the content validity of the questionnaire was also ensured through an extensive review of the literature and detailed evaluation by academicians and practitioners. Some elements derived from different frameworks were modified. Again some more relevant enablers were added looking at the changing scenario of service sector. The survey was administered to eight academicians and seven business professionals working in the areas of lean services. Items were deleted, added, or modified based on their reviews prior to the analysis. Further validation of certain proposed enablers was done using case study approach in Indian scenario.

Construct Validity: A measure is said to have construct validity if it measures the theoretical construct what it claims to be measuring. It subsumes all other types of validity. Construct validity substantiates the theoretical and empirical backing for the interpretation of the construct. This is generally evaluated by Factor Analysis. Factor analysis undertaken on each scale will depicts whether all items within the summated scale will load a single construct or whether the summated scale measures more than one construct i.e., it checks the unidimesionality of the scale. Given the nature and requirement of this study, Exploratory Factor Analysis (EFA) was employed to assess construct validity.

Criterion Validity: Criterion-related validity is "concerned with the extent to which a measuring instrument is related to an independent measure of the relevant criterion" (Talib et al., 2013) and is sometimes also called as external validity. To assess criterion validity in any study one can choose between establishing the concurrent validity or predictive validity of the measurement procedure. Concurrent validity refers to a comparison between the measure in question and an outcome assessed at the same time and predictive validity at later time.

The lean practices have high criterion-related validity if these practices are highly and positively correlated with operational performance of the Indian service companies. The criterion-related validity of the lean practices was evaluated by examining the Pearson's correlation coefficients (r) computed for the lean practices and operational performance as a measure of outcome as well as regression analysis was employed to test the hypothesis H1-H3 (identified in chapter 5).

Factor Analysis: Factor Analysis is a statistical approach that can be used to analyze interrelationships among a large number of variables and to explain these variables in terms of their common underlying factors (Field, 2009). Its primary purpose is to produce a parsimonious set of new composite dimensions from a large number of variables with a minimum loss of information (Hair et al., 2006). It is a multivariate data reduction technique, consisting of identifying a small number of factors that represents relationship among set of interrelated variables. Its main function is measure an unobservable construct using large number of observable items/variables. It is used to uncover the latent structure of a set of variables. The dominant method in operations management literature has been to use factor analysis to combine individual practices in a multiplicative function to form orthogonal and unidimensional factors (Flynn et al., 1995; Cua et al., 2001).

Multiple Regression Analysis: Regression analysis is a statistical technique for reckoning the relationships among variables. Multiple regression analysis is an extension of simple linear regression. The focus is on establishing the relationship between dependent variable (criterion) and one or more independent variables (predictors) in form of mathematical equation. It provides a means of objectively assessing the degree and character of the relationship between independent and dependent variables by forming the variate of independent variables and then examining the magnitude, sign and statistical significance of the regression coefficient of each independent variable (Hair et al., 2006). It determines the overall fit (variance explained) of the model and the relative contribution of each of the predictors to the total variance explained. The goodness of constructed multiple regression equation can be checked by examining the coefficient of determination (R^2). R^2 always lies between 0 and 1. Nearer to 1 it is better is its value. It is assumed that the relationship between variables is linear. The objective of linear regression procedures is to fit a line through the observed points. Specifically, the line is constructed so that the squared deviations of the observed points from that line are minimized in least square estimation. The same technique of least squares was used to estimate multiple regression coefficients for operational performance. It was employed to test the hypothesis H1a – H1i.

Ordinal Regression Analysis: Ordinal regression is a type of regression analysis used for predicting an ordinal variable given one or more predictors or independent variables. It can be regarded as either a generalization of multiple linear regressions or of binomial logistic regression. It can also use interactions between independent variables to predict the dependent variable. It figures out which of the predictors (if any) have a statistically significant effect on your dependent variable. For continuous independent variables, one can interpret how increase or decrease by single unit of a predictor is related with the odds of a dependent variable having a higher or lower value. It also depicts how well the ordinal regression model predicts the dependent variable. As the business performance factors are measured as ordinal variables hence the study has used ordinal regression to test the hypothesis H2 and H3.

In linear regression one has R^2 as coefficient of determination which is proportion of the variance in the dependent variable that is predicted from the independent variable. In regression models with a categorical dependent variable approximations are computed instead as it is not possible to compute a single R^2statistic that has all of the characteristics of R^2 in the linear regression model. Thus the following three methods are used to estimate the pseudo R^2: Cox & Snell (1989), Nagelkerke (1991) and McFadden

(1973). The model with the largest pseudo R^2 statistic is "best" and taken as pseudo R^2 measure.

Hypothesis Testing: Hypothesis testing begins with a postulation, called a hypothesis, which is made about a population parameter. Sample data is collected, sample statistics is calculated, and then this information is used to infer the likelihood that the hypothesized population parameter is accepted.

6.3 Data Analysis

6.3.1 Descriptive Statistics

Before checking for reliability and validity of the measuring items, the existence of outliers and normality were checked. Mahalanobis distances of predicted variables were used to detect multivariate outliers. The details of the same have been tabulated in Appendix I from page no. AI-37 to AI-39.Finally, for the normality of the observed variables, the rules of thumb given by Cohen et al., (2013) and Dubey et al., (2015) were followed, i.e. Moderately non-normal data i.e. univariate skewness <2, univariate kurtosis <5 were acceptable. The present data fulfils the above requirement. The overall statistics for various measures is as shown in various tables in Appendix I from pages nos. AI-40 to AI-45.

6.3.2 Reliability Analysis

Inter item correlation matrix was constructed for each construct to appraise the magnitude of the common trait present in the items, before determining the reliability or Cronbach's alpha. Low inter item correlations are indications of affiliated items wrongly selected (Nunnallly, 1978). Reliability is assessed through the following means – (i) item-to-item correlation is more than 0.3, and (ii) Cronbach's alpha is at least 0.7 (Mitra & Datta, 2014).

Table 6-5 shows the reliability analysis for Lean Service constructs and operational performance construct. The Cronbach α value for all construct is above the threshold value of 0.7 demonstrating internal consistency of established scales .Appendix AI-46 to AI-63 shows the reliability analysis using SPSS 20. The reliability analysis showed that item to item correlation is above 0.3 and alpha value is ranging from 0.834 to 0.939 which is quite high above the threshold value of 0.7, hence all items within the constructs can be considered for further analysis. It is noted that constructs with higher number of items shows higher reliability. The measurement developed in the study is based on extensive literature review and practitioners/experts inputs, the values demonstrated are considered as highly adequate. Inter item correlation is equal to and greater than 0.3 and/or mean item correlation of construct greater than equal to 0.3 is considered to be adequate enough for further analysis (Field, 2009). The present data fulfils both the above conditions hence is adequate enough to move further for analysis.

Table 6-5: Reliability Analysis for Lean Service Constructs

S. No	Construct	No. of Items+	Item Means for Scale	Mean of Inter Item Correlation	Cronbach Alpha (α)	Standardised Item Alpha (α)
1	Top Management Commitment	5	3.841	0.606	0.884	0.885
2	Human Resource & Change Management*	7 (9)	3.709	0.575	0.904 (0.922)	0.905 (0.923)
3	Customer Relationship Management	4	4.060	0.641	0.887	0.887
4	Elimination of Waste	5	3.794	0.587	.877	.875
5	Continuous Process Improvement*	6(8)	3.944	0.686	0.929 (0.926)	0.929 (0.927)
6	Supplier Management	4	3.434	0.778	0.933	0.933
7	Information Technology and Knowledge Management	8(4+4)#	3.877	0.638	0.934 (0.887) (0.919)	0.934 (0.888) (0.920)
8	Servicescape	4	4.022	0.717	0.909	0.909
9	Operational Performance	8	3.851	0.636	0.939	0.940

* Items were dropped in FA.
+ Numbers in parenthesis indicate the statistics of items originally present. Items were dropped in FA.
# Two constructs (Information Technology Management and Knowledge Management) got clubbed in FA.
Note: None of the items were dropped in this stage, as α values are all above 0.7 for all constructs.

The reliability analysis was done for nine lean service practices and operational performance followed by factor analysis. After factor analysis two items in each Human

Resource and Change Management and Continuous process improvement were dropped due to low factor loadings. Two lean services constructs of information technology management and knowledge management got clubbed as items of these constructs loaded on same factor. Hence reliability analysis was conducted again on these modified constructs. The figures in parentheses in table 6-5 indicate the statistics of items originally present before factor analysis.

6.3.3 Factor Analysis

It is a multivariate data reduction technique, consisting of selecting the method of extracting the factors and the method of rotation for interpretation of the factors (Talib et al., 2013). To confirm and examine the details of an assumed factor structure principal component analysis method with varimax rotation was carried out on nine pillars of leans services and operational performance comparing 55 items by using SPSS 20.0 software. Similar approach was followed by Sharma & Kodali (2012) to validate the framework of manufacturing excellence. Mu et al. (2007) used identical procedure in new product development scenario in China. Talib et al. (2013) investigated relationship between TQM practices and quality performance in Indian service companies using PCA approach.

One of the vital considerations is sample size, before going for factor analysis. There are many views regarding suitability of sample size for factor analysis. As per Osborne & Costello (2009) majority of scale constructions survey (40.5%) have used ratio 5:1 or less, 22.7% have used between 5:1 to 10:1 as per the survey of papers using Factor analysis done by them. According to Hair, et al. (2006) a minimum of five subjects per variable is must for factor analysis to achieve good results. In the present study the sample size is 286. As it is greater than minimum requirement of 275 (55 variables*5), hence is adequate enough to go for factor analysis. Lean initiatives item bivariate correlation tables in Appendix I on pgs AI-64 to AI-67 shows all correlations are significant .Further the Kaiser –Meyer-Olkin measure verified the sampling adequacy for analysis, KMO = 0.926, which is well above the acceptable limit of 0.6 (Hair et al., 2006; Field, 2009). Bartlett's test of sphericity χ^2 (1081) = 13129.03, $p<.001$, is significant. It indicates that correlations among the items/variables are sufficiently large enough to go for factor analysis. The anti-image correlation matrix too revealed that measure of sampling adequacy (MSA) of each individual item is well above the threshold value of 0.5, which substantiate the application of factor analysis on the data. The mean value of communalities was 0.747, which is regarded to be a good measure of the adequacy of sample (MacCallum et al., 2001). They also suggested that high communalities indicate normally very good recovery of population factors in sample data, almost regardless of sample size, level of over determination or the presence of model error.

Running factor analysis suggested eight factors or components are adequate enough to represent the data. These eight factors had eigen value above the Kaiser's criterion of 1 and together explained more than 70% of the variance. The construct of information technology management and knowledge management construct got clubbed together as the items of these two constructs loaded on the same factor. The two constructs were clubbed as one and the new construct was renamed as Information Technology and Knowledge management after consultation with experts.

Next, factor loadings were obtained for each item. The loadings reveal the strength of relationship between an item and particular construct or factor. Higher the loading is; higher the strength or better the representation that item has on construct. In interpreting the factor loadings; the loading in excess of 0.45 could be considered fair, greater than 0.55 as good, 0.63 is very good, and 0.71 as excellent (Comrey, 1973; Hair et al., 2006; Field, 2009). For this study, a loading of 0.50 or greater on the factor was considered (Hair et al., 2006; Arumugam et al., 2009; Fullerton & Wempe, 2009). Two items of continuous process improvement and two items of human resource and change management were dropped due to low factor loading. Finally 43 items which distinctly loaded on the construct were retained for further analysis. The factor analysis after the dropping of items suggested KMO = 0.926 and Bartlett's test of sphericity χ^2 (903) = 11783.305, p<.001. The eight factors extracted explained 74.72% of the variance. Table 6-6 summarises the result of factor analysis. The detailed analysis is depicted in Appendix I page no AI-68 to AI-73.

Similarly, another factor analysis was performed on dependent variable i.e. operational performance represented by eight items. A single factor solution emerged explaining 70.622% of variance having eigen value of 5.650. The KMO measure of sampling adequacy was 0.927 while the Barlett's test of spherecity was significant (χ^2 =1812.390, p=0.0000<0.01). The result of factor analysis is summarised in table 6-7. The detailed analysis is depicted in Appendix I page no AI-74

Table 6-6: Result of Factor Analysis of Lean Service Constructs

Items	Factor Loadings	Measure of Sample Adequacy	Communalities
Top Management Commitment			
Acts as change leader	0.686	0.914	0.698
Vision & mission echo the principles of lean thinking leader	0.675	0.891	0.777
Inclination on quality rather than cost.	0.708	0.933	0.721
Resources and time allocation for Lean.	0.649	0.909	0.713
Understanding of Lean activities and practices	0.736	0.919	0.803
Human Resource and Change Management			
Willingness and motivation for change.	0.579	0.904	0.654
Organisation culture is supportive of lean.	0.682	0.927	0.781
Employees as partners.	0.649	0.927	0.721
Trainings in lean tools, problem identification etc.	0.700	0.896	0.720
Trainings in interactive / social skills.	0.762	0.904	0.728
Multi skilled employees and cross functional	0.525	0.957	0.659
Employees empowerment	0.552	0.924	0.616
Employees' satisfaction related to lean. [a]	0.477	0.940	0.724
Financial and non-financial incentive related to lean.[a]	0.468	0.926	0.684
Customer Relationship Management			
Voice of Customer	0.630	0.948	0.791
Customers' periodic surveys /feedbacks etc.	0.790	0.882	0.843
Extensive customer service program.	0.741	0.895	0.791
Comprehensive database of customers.	0.556	0.908	0.635
Elimination of Waste			
Current/future state analysis using VSM.	0.640	0.938	0.769
Visualisation of process maps and updating them.	0.592	0.904	0.721
Eliminating/reducing wastes	0.681	0.926	0.825
Producing defect free services.	0.587	0.962	0.636
Quality of input	0.510	0.942	0.681
Continuous Process Improvement			
Periodic meetings to discuss continuous improvement.	0.602	0.938	0.726
Processes have continuous flow	0.684	0.935	0.758
Clearly defined and standardised processes.	0.735	0.920	0.789

Items	Factor Loadings	Measure of Sample Adequacy	Communalities
Measuring all key process metrics	0.709	0.947	0.774
Structured, well defined action plan for problem solving and process improvement.	0.740	0.924	0.818
Using continuous improvement tools	0.661	0.949	0.755
Educating and influencing customers to reduce process variability [a]	0.304	0.936	0.482
Levelling workloads [a]	0.352	0.930	0.682
Supplier Management			
Suppliers as partners.	0.786	0.917	0.822
Training programmes for suppliers.	0.823	0.925	0.847
Supplier selection based on value addition and not only on cost.	0.738	0.897	0.795
Extensive supplier management programme.	0.800	0.885	0.876
Information ,Technology and Knowledge Management			
Locating and sharing information as needed	0.697	0.929	0.724
Managing accuracy, timeliness, relevance, quantity and form of information.	0.566	0.966	0.672
Use of reliable & thoroughly tested technology	0.701	0.926	0.757
Enhancing technological capability to serve	0.755	0.924	0.764
Enhancing the knowledge base for lean.	0.638	0.930	0.783
Developing new/innovative services and practices.	0.622	0.946	0.720
Transforming tacit knowledge into explicit organisational knowledge	0.662	0.943	0.769
Capturing , reviewing, standardising and sharing learning , best practices etc.	0.569	0.956	0.675
Servicescapes			
Comfortable, clean physical environment and ambient conditions.	0.721	0.935	0.775
Equipments, physical facilities, signboards etc. to educate and influence customers.	0.735	0.917	0.756
Physical layout, facilities etc. support uninterrupted flow.	0.691	0.928	0.828
Employees with pleasing and neat appearance for quality assurance.	0.795	0.912	0.766

Notes: KMO= 0.926; $\chi^2 = 11783.305$, $p<0.01$; Variance explained =74.72%; Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization; eight components extracted [a] deleted items due to low factor loading (<0.50)

Table 6-7: Result of Factor Analysis of Operational Performance

Items	Factor Loadings	Measure of Sample Adequacy	Communalities
Wastes Reduction	.850	0.928	.722
Costs Reduction	.832	0.928	.693
Resource Utilisation	.887	0.932	.787
Quality	.851	0.953	.724
Delivery	.875	0.910	.765
Flexibility	.829	0.918	.687
Customer Satisfaction	.831	0.931	.690
Innovation	.763	0.915	.582

Notes: KMO= 0.927; χ^2 = 1812.390, p<0.01; Variance explained =70.72%; Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization; One component extracted

6.3.4 Construct Validity

Construct validity is the appropriateness of inferences made on the basis of observations or measurements, particularly whether the scale/instrument measures the projected construct. Factor analysis was conducted on each construct of lean practices for assessing the construct validity of the constructs (Hair et al., 2006). Each scale was subjected to factor analysis separately to check the unidimesionality of constructs. The result in Appendix I pages AI-75 to AI-82 shows that the factor analysis depicted unidimesionality under each main construct or summated scale.

6.3.5 Criterion Related Validity

It is evident that scores from an instrument correspond with external measures conceptually related to the measured construct. Traditionally it is assessed by analysing the correlations of constructs with one or more measure of operational or business or manufacturing performance (Saraph et al., 1989). The eight lean practices have high criterion-related validity if these practices are highly and positively correlated with operational performance of the Indian service companies. Thus the criterion-related validity of the consolidated set of eight lean practices was assessed by inspecting the Pearson's correlation coefficients (r) computed for the eight lean practices and operational performance as a measure of outcome as shown in table 6-8.

Table 6-8: Bivariate Correlation matrices

	OP	TMC	HRCM	CRM	EO	CPI	SM	ITK	SS
OP	1								
TMC	.579**	1							
HRCM	.628**	.688**	1						
CRM	.573**	.467**	.589**	1					
EOW	.759**	.507**	.622**	.548**	1				
CPI	.753**	.524**	.571**	.635**	.726**	1			
SM	.685**	.530**	.599**	.370**	.612**	.584**	1		
ITKM	.769**	.655**	.636**	.588**	.645**	.693**	.580**	1	
SS	.661**	.446**	.440**	.562**	.612**	.621**	.459**	.661**	1

** Correlation is significant at the 0.01 level (2-tailed).

Legend: OP: Operational Performance, TMC: Top Management Commitment, HRCM: Human Resource and Change Management, CRM: Customer Relationship Management, EOW: Elimination of Waste, CPI: Continuous Process Improvement, SM: Supplier Management, ITKM: Information, Technology and Knowledge Management, SS: Servicescapes

It was found that all the lean practices had significant positive correlation ($p < 0.01$) with operational performance. The strongest relationship is with Information technology and Knowledge management (r= 0.769, p<=.01) followed by Elimination of waste(r= 0.759, p<=.01) and continuous process improvement (r= 0.753, p<=.01) of operational performance. The weakest relationship is with customer relationship management (r= 0.573, p<=.01). The results also signify that respondents had high levels of organisation's operational performance. All 36 correlation coefficients are larger than 0.20. The highest coefficient of correlation in the research is 0. 769 which is below 0.90, the cut-off value for the collinearity problem. Further, all correlation coefficients between the independent variables and dependent variable were less than 0.90, indicating that the data was not affected by a multicollinearity problem (Hair et al., 2006). Hence, the data in the research has no collinearity and multicollinearity problem. The results further indicated that the technical lean practices information technology and knowledge management, elimination of waste, continuous process improvement, supplier management are affecting operational performance more than soft practices of top management commitment, human resource and change management etc as their scores are higher. The impact of technical lean practices on OP is more clearly visible as they directly impact it. Whereas the soft practices of lean are indirectly related or act support services. They are instrumental in creating culture, behaviour and attitude towards lean management, but their influence on operational performance is not clearly visible. Thus these soft practices are showing moderately positive relationship whereas hard practices are having strong positive relationship.

6.3.6 Multiple Regression Analysis

Multiple regression analysis was used to test hypotheses about the impact of individual predictors on the dependent variable or to assess their relative significance. The analysis was executed to better understand the relationships between lean practices and operational performance.

Sample size is an important consideration in multiple regression as it has direct impact on the appropriateness and statistical power of multiple regression. As per Hair et al., (2006) the general rule is that the ratio should never fall below 5:1 (five observations for each independent variable), the desired level is between 15-20 observations for each independent variable. The ratio for the present study is 35.75: 1. Thus the sample size is adequate for the analysis. Stepwise method of regression analysis was conducted, hence only those variables out of the eight lean practices that significantly contribute to the variance of the operational performance (dependent variable) will be entered in the equation. The variable that is entered first is the one which has the highest correlation with the criterion variable; Information Technology and Knowledge Management in this case. The next variable entered is the one with the next highest correlation. Once the common variance with the variable already entered is removed, and so on, the process continues until all the variables that significantly add to the prediction are accounted for in the equation.

The model summary and results of the analysis and is depicted in table 6-9. There is no auto correlation problem in data as the Durbin-Watson index is at 2.024, which lies within the range of 1.50-2.50 (Durbin & Watson, 1951). Also, from table 6-9, each of the variables had a tolerance value of more than 0.10 and variation inflation factor (VIF) of less than 10. These results stipulates that the model had no serious multicollinearity problem (Hair et al., 2006); as also found in Pearson's correlation analysis in the previous section. Thus from these investigations, one can infer that all the assumptions required to ensure validity of multiple regression model's significance test are met. The regression model in equation form is as:

OP= 0.293+0.282ITKM+0.221 EOW+0.151 SM+0.168 CPI+0.111 SS

Scatter and Normal P-P plots of standardize residual were administered to check the normality, homoscedasticity, linearity, and outliers, if any. The figures 6-13 and 6-14 indicate normality and consistent variance of the error terms i.e. homoscedasticity. The figure 6-14 also depicts lack of apparent relationship between the residual and the predicted values which is accordant with the assumption of linearity.

Table 6-9: Model Summary

Model	Operational Performance (OP) (Dependent Variable)			Collinearity Statistics	
Independent Variables	**Unstandardised Coefficients**	**β**	**Sig. (p)**	**Tolerance**	**VIF**
(Constant)	0.293		0.024	0.398	2.514
ITKM	0.282	0.289	0.000	0.384	2.601
EOW	0.221	0.241	0.000	0.554	1.805
SPM	0.151	0.210	0.000	0.368	2.718
CPI	0.168	0.186	0.000	0.490	2.041
SS	0.111	0.110	0.008	0.398	2.514
R^2		0.763			
Adjusted R^2		0.759			
F Change		7.061			
Sig. F Change		0.008			
Durbin Watson		2.024			

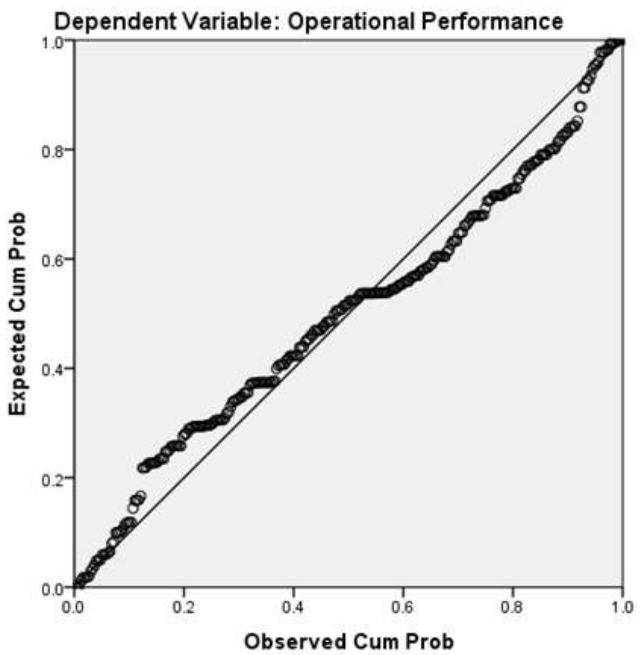


Figure 6-13: Normal P-P Plot of regression standardised residual

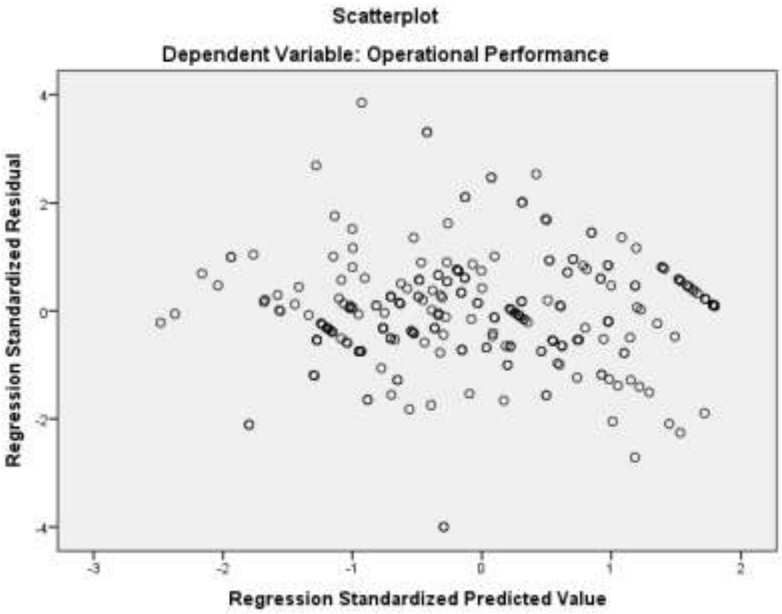


Figure 6-14: Scatter Plot

As per Cohen (1998) R^2 value between 1.0 and 5.9 percent is considered as small, between 5.9 and 13.8 percent is medium, and above 13.8 percent is large. From Table 6-9, it can be seen that value of R^2 (coefficient of determination) was 0.763, demonstrating that 76.3 percent of operational performance can be explained by the five independent variables. This indicates that lean can significantly account for 76.3 percent of variation in operational performance. The proposed model was acceptable as the F-statistics {F (1,280) = 7.061} was significant at 1 percent level ($p < 0.01$). This states that the overall model was statistically significant and there is positive relationship between lean practices and operational performance.

The detailed tabulated results of multiple regression analysis, including the unstandardised coefficients, standardized β coefficients and t-value significant level are presented in Appendix I page no AI-83 to AI-86. The results reveal that statistically five practices of lean, namely: elimination of waste; continuous process improvement; supplier management; information, technology and knowledge management; and servicescape are positively associated with operational performance. The individual model variable revealed that elimination of waste (β=0.241, p<.01); continuous process improvement (β=0.186, p<.01); supplier management (β=0.210, p<.01); Information, technology and knowledge management (β=0.289, p<.01); and servicescape (β=0.110, p<.01); are all directly implicated in the enhancement of operational performance. Therefore, H1d - H1i were supported. Meanwhile, top-management commitment; human resource and change management, customer relationship management had no statistically significant effect on operational performance. These practices provides strategic and infrastructural benefits acting as supportive as well as necessary for the continuous lean improvement over time having relationship with operational performance. Thus H1a to H1c are not supported statistically. Thus H1 was partially supported statistically.

6.3.7 Ordinal Regression Analysis

Ordinal regression analysis was used to test hypotheses about the impact of lean practices and operational performance on business performance to assess their relative significance. The business performance is measured by change in profits, change in market share, change in customer base, and change in annual sales turnover since the inception of lean.

SPSS 20 was used to conduct ordinal regression using log it function. The analysis is depicted and discussed below. One needs to test for the adequate prediction of model before looking at the individual predictors. Therefore; one examines the model fitting information. The significant chi-square statistic indicates that the model gives a significant improvement over the baseline intercept-only model. The final model is compared against the baseline to see whether it has significantly improved the fit to the data. The statistically significant chi-square statistic ($p<.05$) indicates that the final model gives a significant improvement over the baseline intercept-only model. In all four ordinal regression analysis the chi square statistic is significant. The result of the analysis is given in table 6-10. The detailed tabulated results of ordinal regression analysis are presented in Appendix I page no AI-87 to AI-96.

The analysis shows that all lean practices and operational performance have positive impact on all business performance. The positive coefficients indicates that higher values of the explanatory variable are associated with higher outcomes, while negative coefficients tell you that higher values of the explanatory variable are associated with lower outcomes of the dependent variable.

Table 6-10: The Exponential β Estimates of Business Performance

Independent Variable	Profits	Market Share	Customer Base	Ann. Sales T/O
Pseudo R-Square	19.2%	12.5%	14.2%	9.3%
TMC	1.542**	1.119	1.005	1.470*
HRCM	0.717	0.834	1.201	1.009
CRM	0.890	0.789	1.180	0.898
EOW	1.457	1.824**	1.875**	1.188
CPI	1.724**	1.163	0.746	1.187
SPM	0.959	1.469**	1.076	1.345*
ITKM	0.505**	0.668	0.766	0.627*
SS	0.647*	1.207	0.822	1.055
OP	3.180**	1.062	1.847*	1.112

** $p<0.05$, *$p<0.10$

The results show that the lean practices of elimination of waste and supplier management are statistically significant with market share. The other lean practices of top management commitment, human resource change management, customer relationship management, continuous process improvement, information technology and knowledge management and servicescape were found to have statistically no significance with market share hence hypothesis H2a: Lean practices are positively related to business performance of market share is partially supported.

The lean practices of top management commitment, continuous process improvement and information, technology and knowledge management and servicescape are statistically significant with profits. The other lean practices of human resource change management, customer relationship management, elimination of waste and supplier management were found to have statistically no significance with profits hence hypothesis H2b: Lean practices are positively related to business performance of profits is partially supported.

The lean practices of top management commitment and supplier management are statistically significant with annual sales turnover. The other lean practices of human resource change management, customer relationship management, elimination of waste, continuous process improvement and servicescape were found to have statistically no significance with annual sales turnover hence hypothesis H2c: Lean practices are positively related to business performance of annual sales turnover is partially supported.

The results depicts that lean practices of elimination of waste is statistically significant with customer base. The other lean practices of top management commitment, human resource change management, customer relationship management, elimination of waste, continuous process improvement, supplier management and servicescape were found to have statistically no significance with customer base hence hypothesis H2d: Lean practices are positively related to business performance of customer base is partially supported. Thus hypothesis H2 is partially supported

Operational performance is also positively statistically significant with profits and customer base only and shown no statistical significance with market share and annual sales turnover. Thus hypothesis H3 is partially supported.

6.4 Results and Discussion

This section presents a detailed discussion of the results achieved in regard with the hypotheses associated with the impact of lean practices on firm’s operational and business performance and the impact of operational performance on business performance. Table 6-11 summarises the results of hypothesis tests.

The reliability analysis established internal consistency of the constructs as the Cronbach α value for all construct was above the threshold value of 0.7. Hence all items within the constructs were considered for further analysis. Factor Analysis led to clubbing of two constructs and dropping of few items in two of the constructs. Finally eight factors were extracted explaining 74.72% of the variance in Lean services. Factor analysis performed on dependent variable i.e. operational performance represented by eight items extracted single factor solution explaining 70.622% of variance. Factor Analysis on each construct depicted unidimesionality of construct, thus proving the construct validity of each construct. Significant Pearson’s correlation coefficients (r) between operational performance and eight lean service construct established the criterion validity. The maximum value of Pearson’s correlation coefficient (0.769) between dependent and independent variable suggest no problem of multicollinearity in data as it was less then threshold value of 0.9.

Table 6-11: Hypothesis Results Summary

Hypothesis	No.	Results
Top management commitment in an organisation is positively associated with operational performance.	H1a	Reject
HR &change management in an organisation is positively associated with operational performance.	H1b	Reject
Customer relationship management in an organisation is positively associated with operational performance.	H1c	Reject
Elimination of waste in an organisation is positively associated with operational performance.	H1d	Accept
Continuous Process Improvement in an organisation is positively associated with operational performance.	H1e	Accept
Supplier relationship management in an organisation is positively associated with operational performance.	H1f	Accept
Information, Technology and Knowledge management in an organisation is positively associated with operational performance.	H1g-h	Accept
Servicescapes in an organisation is positively associated with operational performance.	H1i	Accept
Lean service practices are positively associated with annual sales turnover.	H2a	Partially Accepted
Lean service practices are positively associated with market share.	H2b	Partially Accepted
Lean service practices are positively associated with profits.	H2c	Partially Accepted
Lean service practices are positively associated with customer base.	H2d	Partially Accepted
Operational Performance is positively associated with annual sales turnover.	H3a	Reject
Operational Performance is positively associated with market share.	H3b	Reject
Operational Performance is positively associated with profits.	H3c	Accept
Operational Performance is positively associated with customer base.	H3d	Accept

Further regression analysis was done for hypothesis testing. Overall, the outcome of this study stipulated that the lean practices were found to partially impacting the operational performance (H1) as proven by multiple regression analysis. They also partially impact the business performance (H2) of the Indian service companies as statistically proven by ordinal regression analysis. The operational performance also has partially positive impact on business performance (H3) of the service companies statistically proven by ordinal regression analysis.

These results are significant as they empirically validate the premise in the literature that lean practices in services improve firm’s operational performance despite the challenging characteristics of service operations (Ahlstrom, 2004; Malmbrandt & Ahlstrom, 2013; Hadid et al., 2016) .The results indicate that positive impact is driven by the factors of elimination of waste, continuous process improvement, supplier management, information, technology and knowledge management and servicescapes. The factors of top management commitment, human resources management & change management, customer relationship management though have high positive correlation with operational performance didn't associate statistically significantly with measures of operational performance.

The results are similar to the findings by (Bonavia & Marin, 2006), (Dal Pont et al., 2008), (Talib et al., 2013). Bonavia & Marin(2006) found that none of the soft practices of multi-functional employees and group suggestions programme were capable of improving any of the operational performance indicators. Dal Pont et al. (2008) survey of 266 plants also found that Human Resource Management do not have per se direct impact on operational performance, but favour the implementation of operative practices i.e. JIT and TQM for lean which in turn have an impact on operational performance. In study done by Talib et al., (2013) on impact of TQM practices on quality improvement on Indian services found no significant relationship of top management commitments, customer focus, human resource management with quality improvement.

These findings should not entail that these factors (top management commitment, human resource & change management, customer relationship management) are not significant practices of lean service and can be simply ignored. Top management is responsible for permeating the shared vision of the transformation to the entire organization as lean is an exercise towards cultural change (Damrath, 2012; Sarkar, 2007). Human resource strategy has to be in alignment with transformation strategy for successful implementation of transformation methodology. Customer relationship is vital in services as the involvement of the customer in service creation process and delivery process is an imperative element of services. Malmbrandt & Ahlstrom (2013) Srichuachom (2015) have called these soft practices: top management commitment, human resource & change management, customer relationship management of lean as enablers or supporting structures whose adoption has increasingly been held up as critical for successful lean implementation. These enablers are directly unable to answer the question of whether they have actually led to any improved performance results but these lean elements support the implementation of lean tools to align and fit with an organisation’s environments. Thus it is synergistic effect of all lean practices which lead to enhancement of performance leading to competitive advantage.

The literature has been divided about the impact of lean on business performance and this study has got mixed result supporting the literature. Lean practices and operational performance were found to be partially impacting business performance. The lean practices of top management commitment has significant impact on profits and annual sales turnover, elimination of waste positively impacted market share and customer base, continuous process improvement positively impacted profits, supplier management positively impacted annual sales turnover and information, technology & knowledge management positively impacted profits and market share. Operational performance had positively and significantly impacted profits and customer base.

The results of ordinal regression accord the findings of various authors (Fullerton & Wempe, 2009; Losonci & Demeter, 2013; Hadid et al., 2016) relating lean practices and operational performance with business performance. In study by Fullerton & Wempe(2009) lean practices of quality initiatives have no impact on profitability while set up reduction had marginal significant relationship and cellular manufacturing has strongest relationship. Operational performance impacted profitability positively. In the present study too operational performance has significant relationship with profits of the organisations. Losonci & Demeter, (2013) had empirically proven that lean practices though impact operational excellence had no impact on business performance. Research by Hadid et al. (2016) not been able to capture positive impact of lean technical practices (process factor, error prevention, physical structure and customer value) on business performance of profit margin, turnover per employee and return on capital employed. But the human factor positively impacted return on capital employed and the motivation factor on profit margin.

The partial association of lean practices and operational performance on business performance can also be credited to the time needed after the adoption of improvement practices before its benefits materialise and are reflected in financial statements (De Menezes et al., 2010; Hadid et al., 2016). Figure 6-9 depicts that time period since adoption of lean is 0 to 3 years for majority of respondent organisations. It takes 3-5 years or more for impact of any improvement methodology to reflect on business performance. Thus the lack of association might be due to the fact that not enough time has elapsed so that benefits of these practices has not accumulated to a level that they are reflected in the business performance of firms. Secondly, business performance performances of sales, profits, market etc. are not only affected by the implementation of lean thinking. There is also a possibility that these business performances were affected by many other factors are many factors beyond operational factors which impact business performance like market dynamics, new entrant, competitiveness which are beyond the scope of operations management (Losonci & Demeter, 2013). As the majority of respondent service organisations in this study are found to be at nascent stage of lean implementation, thus the significant impact of lean on business performance has been partial.

6.5 Conclusion

In this chapter the survey responses were analysed for empirically testing the proposed framework for lean services, operational performance and business performance. Indian service industry though is aware of the lean practices is still at nascent stage of lean implementation. The industry is adopting the process improvement methodology to achieve operational excellence, improving quality and customer satisfaction. The extensive use of lean practices of cause and effect analysis and Pareto chart indicates interest of industry in eradicating root cause of problem and not looking at short term gain. Further various statistical tools like the descriptive statistics, reliability analysis, correlation analysis, factor analysis, regression analysis were used. The data was analysed using SPSS version 20.0. The projected framework was investigated on the basis of 286 valid responses received. The framework was found to be reliable and valid on various measures. It proved that Indian service industry very much aware about the lean practices and its impact on operational and business performance. The findings indicate that lean practices have direct positive impact on number of operational performances leading to cost savings, waste reduction, improving the delivery of services. The Indian service industry is adopting lean practices to achieve service excellence, improving service quality leading to enhanced customer satisfaction.

CHAPTER 7: APPLICABILITY OF THE PROPOSED LEAN SERVICE FRAMEWORK: A CASE STUDY APPROACH

7.1 Introduction

Case study is an empirical inquiry probing a contemporary phenomenon within its real life context (Yin, 1984). The case study approach assists in extensive and more detailed investigation to answer how and why questions (Yin, 1984). It allows profoundly, comprehensive explorations of intricate issues in their real-life settings. It uses manifold data sources including direct detailed observations, interviews, documents etc. Case study research excels in an understanding of a complex issue and can extend experience or add strength to what is already known through previous research (Soy, 2015). The case study method follows the survey methodology. Case study method in combination with survey aids in comprehensively developing explanations for the findings. By including both quantitative and qualitative data, it helps in explaining both the process and outcome of a phenomenon through complete observation, reconstruction and analysis of the cases under investigation (Zainal, 2007; Tellis, 1997). Case study research has number of advantages:

- It permits a researcher to closely examine the data within a particular context.
- It allows for an empirical investigation of the phenomenon within its real-life settings.
- It aids in inferring causal relationship with more validity due to longer term observations.
- It aids to explain the complexities of real life situations which may not be captured through experimental or survey research.

Case studies are suited in places where happenings and the situation in which they exist are difficult to separate. The same conditions apply in this research. The exploratory survey was followed by the case study methodology. The case studies were contemplated to help in enrichment of the proposed framework, thus supplementing its exploratory and prescriptive characteristics.

In the previous chapter the theoretical framework of lean services proposed in chapter five was empirically investigated. Two case studies were conducted in two different service sectors at different stages of lean implementation. To assess the applicability of proposed framework an attempt was made to check the level of implementation of lean practices in an Indian service organisation. The first case study was undertaken in an IT/ITES company which has been practicing lean for more than 3 years. The aim was to see the impact of lean enablers in a service organisation which has been working in lean management for considerable period of time. The second case study was conducted in an organization in health care sector which had no previous experience in lean management. This case study was done to see the effect of lean practices adoption by Indian service organisation with no experience in lean for improvement of quality of services, its delivery and their bottom line.

7.2 Case Studies

7.2.1 Applicability of the Proposed Framework in an Indian Service Organisation

The aim of the case study was to assess the applicability of the proposed framework of lean services in an Indian service organisation. The organisation selected was an ITES company practising lean for more than 3 years. For technical reasons identity of the case company is not disclosed. The researcher met and interviewed 10 lean practitioners working at middle and senior management level for getting insight into working of the case company. The method adopted for first case study used was structured interview. The interviewees provided information about the company, the services provided, formal lean initiative adopted, policies followed etc. The improvements shared by company's representatives were in percentage only and data was not shared with researcher for complete analysis. The aim was neither to check the implementation of the framework implemented in the organisation nor was it to check whether every element listed in the proposed framework has been or can be exactly followed by the case organisation. Rather the aim was to ascertain the applicability of lean initiatives followed by the case company as proposed in the proposed framework.

7.2.1.1 About the Case Organisation

The organisation is a subsidiary of an Indian IT multinational organisation. The parent company is one of the top companies serving in IT/ITES sector offering customer-centric, innovative technology services and solutions to over 500 global clients. Many of the clients of the case company are listed in fortune 500 list. The company offer ITES to global clients earning more than US$ 200 million with workforce of more than 25,000, operating in more than 15 countries. It works with the vision to grow and create value for all stakeholders, contributing towards customers' success by enabling the employees to realize their potential. It aims to be in top five leaders in the chosen market segment fostering innovation.

The company offers focused resources and specialized industry expertise spanning the sectors of Retail, Manufacturing, Telecom, Financial and Utilities in diverse geographies. It delivers whole gamut of ITES services in enterprise application services, customer interaction services, finance and accounting, IT managed services, human resource services, research & analytics and data management. The services offered are powerful confluence of operational excellence, field expertise and superior technology. The company offers integrated end-to-end custom-designed and expertly implemented outsourcing services fitting the business needs of the clients creating impactful solutions driving excellence into their business processes. The approach aims for productivity improvements, process optimisation, cost reduction and business agility.

7.2.1.2 Implementation of Lean Practices in Call Centre

Call centres are multichannel contact centres which are looking for improved service delivery & value creation because of intense competition and high employee turnover. Cost reduction is the need of the hour because of falling margins and prices. On the other hand, customers are demanding consistency and better services. Improving services of call centre will also leads in improving market share and enhancing customer experience in a competitive global economy.

The most commonly measured efficiency indicators in call centre are:

- First Call Resolution (FCR) %
- Repeat Calls %

- Average Handling Time (AHT)
- Average speed to answer
- Waiting time/Queue Time
- SLA (Service Level Agreement) % for TAT (Turnaround time)
- C-SAT Score (Customer Satisfaction)
- Revenue per agent
- Average cost per agent
- Average Revenue loss on account of call abandoned
- Manpower Utilization

The case organisation's main objective for adopting Lean approach was to improve its operational performance thus converting itself from cost centre to a profit centre. As an endeavour towards lean approach it started with organising **education and training sessions** about lean practices and tools like **value stream mapping, root cause analysis, standardisation** etc. The emphasis was on focusing on customer touch points and identification of process improvements from customers' point of view and not only market's point of view.

The organisation had implemented the lean approach of waste elimination in different areas using the following five steps:

a. **Voice of Customer (VOC)**
b. Define the problem
c. Mapping Value Stream
d. Identifying the waste
e. Minimising/Eliminating the waste

a. *VOC*: The organisation captures the VOC using feedback mechanism. The feedback helps in identifying the demands or needs for external and internal customers. It also provides help in identifying the stakeholders impacted.
b. *Define the Problem:* On starting the lean journey the main identified problematic areas were low FCR%, high average handling time, high number of repeat calls, high level of absenteeism/attrition of employees, communication gap.

c. *Mapping Value Stream:* Lean tool of **value stream mapping (VSM)** was used for analyzing the current state and designing the future state for the series of events, considering all touch points that takes a service from the customer's request to delivery. VSM helped in visualising and understanding at the flow of dialogue exchange, the systems in use and the time required at each touch point from the ringing of the call until the customer hangs up. The organisation mapped the baseline processes and metrics measured in them. It also helped in calculating the benefits or improvements achieved from adopting lean.

d. *Identifying the waste:* **Time and motion study** was instrumental in identifying opportunities for improving the process as it helped in capturing various activities and times associated with them. This acted as an major input in drawing current state value stream map. The "**As Is" maps** aided in understanding the current process and conducting **brainstorming sessions** in identifying each process steps as **value added, essential non value added, non-value added activity**. The time spent in NVA activities increases the call average handling time and talk time, which provided more opportunities for grave errors thus impacting the customer's experience negatively. The team also investigated the seven types of wastes as per lean methodology. The processes in call centre majorly had wastes of over processing, defects and waiting which were found impacting the productivity and customer experience. Some wastes/errors identified were like providing incorrect information to the customer, registering wrong service request, long call scripts, irrelevant probing, unnecessary customer validation, high hold, search or transfer time, call disconnection etc.

e. *Minimising/Eliminating the waste:* Lean practices of **root cause analysis, Pareto analysis, standardisation, kaizen,** etc were used in reducing waste in inbound and outbound calls in the case company leading to improved efficiency and enhanced customer satisfaction.. **Brainstorming sessions** helped in finding the root causes of the identified wastes. **Pareto analysis** helped in identifying the vital 20% of causes which were responsible for 80% wastes. It was seen that type of customer demand (information, enquiry, tracking complaint, service request etc.) and dynamic process were mainly responsible for high average handling time. The case organisation **standardised the processes** on the basis of type of customer demand. Standard script was also prepared to reduce the long scripts, irrelevant probing and unnecessary customer validation. The organisation **revamped the information and knowledge system** giving timely and accurate information along with **more decision making powers to the front line employees.** It also reduced the hold and transfer time, mainly responsible of high average handling time. Future state value stream map drawn after eliminating waste acted as an ideal future condition. On achievement of the same it acted as a baseline for further improvement.

Call log details were analysed to find the main drivers (NVA) of low FCR. As low FCR was leading to repeat call leading to low C-Sat (customer satisfaction) score, customer churning and enhancing the cost of operation. The causes of the same were identified **using root cause analysis (fish bone diagram) and Pareto chart**. By analysing and classifying customer demand, call handling and resolution becomes more manageable and more predictable. New **standardised operating procedures** were established and **knowledge base was improved** with an aim of higher FCR and improved C-Sat score. The employees were provided with the resources (information and knowledge) to effectively resolve complaints. **Employee empowerment** had also helped in reducing absenteeism/ attrition.

These activities have brought in results like:

- Increased C-Sat Score to 85% from 65%
- FCR% has improved to 87% from 60%
- Average handling time reduced by 20%
- Reduction in absenteeism/attrition by 8%
- Employee satisfaction increased by 40%
- Service upgrades
- Reduced operating cost by 10%

Encouraged and motivated by successful results the company is striving to make lean as the way of life. It is continuing with above lean approach to tackle the various problematic areas. To make lean as the way of life the organisation had set up NVA Measurement System, with regular audits focusing on NVAs. Thus company is striving to create a culture of lean thinking and problem solving. The feedback from it is being fed back to operations and training department. The company is working towards sharing information as and where needed. IT along with knowledge management is being used to capture and share the results among different departments so the same can be used for organisational learning and audits. The input helps in assessing the processes health. It is also being used for further training of employees for necessary preventive and corrective actions. The feedbacks of operations/training are sent to hiring managers for helping in recruitment of candidates with right background and experience.

As a way forward, the case organisation views itself from point of view of customer; redefining relationship between employees and customers. Thus company is listening and focusing on voice of customer. To improve its relationship it's redefining its procedures from point of view of clients/customers. New key performance indicators and service-level agreements were developed around the business goals and rules of the clients, not the processes and targets of company's employees. The company is working with clients to replace traditional service measures with new business measurements. Clients are now charged for each prospective user of the service, not on the basis of number of calls placed. The front line employees are measured on the number of reduced calls and the number of suggestions that improve overall service delivery, not just the service related to the call. The organisation has stopped measuring average talk time and focus is on high percentage of FCR. It believes as employees listen to people all day long, they are solicited for suggestions to improve services. Front lines employees are trained in identify the problem, fix it, and take the necessary measures to prevent it from recurring. This increases the average handling time, but it is viewed in positive manner if it is reducing the number of total unwanted calls.

Managers acts as support providing know how and resources to front line staff to satisfy the need of the customers thus working on enhanced employee engagement. They are getting the chance to solve more challenging problems and gain greater satisfaction. Rewards are based on how much knowledge they have created and not the number of calls they handle. This has led to improvement in employee satisfaction too.

As the company was found moving on the right path of adopting lean, further the company analysis was done using the survey instrument for validating the proposed framework. The findings from the survey are discussed further.

7.2.1.3 Improvement Activities as per Lean Service Pillars:

Assessments of lean practices followed by the case organisation are discussed below. Since the company has been practicing lean for more than 3 years it was found to be perfect for investigating the applicability of proposed framework. The 10 people interviewed were working in lean since last 1 to 5 years. Case organisation has adopted lean management to enhance operational excellence and service quality for customer satisfaction. The same has been the case with other service industries as seen in survey results. They are adopting lean to solve chronic problem thus looking for the root cause(s) and eliminating the same. The tools majorly implemented include VSM, cause and effect analysis, waste reduction/elimination, Pareto Analysis, standardisation and cross functional teams. Survey results also suggested that these lean tools were extensively being used in service industries.

7.2.1.3.1 Top Management Commitment

The assessment of Top Management commitment for lean practices has been depicted in table 7-1 below. The perceptions of the lean practitioners on the five items are collated on five point likert scale. The case study company has been found wanting on top management commitment. As it is subsidiary of an MNC and still being managed centrally, the top management commitment is not visible enough. All the decisions are taken by the parent company. The active leadership in form of Gemba Walk or attending Kaizen events with employees is missing. Top Management commitment is important as it governs the strategy building and resource allocation for lean management. Decentralisation is needed with more power being given to case company. The overall mean of the surveyed companies and case study company for top management commitment can be seen in radar chart in figure 7-1.

Table 7-1: Assessment of Top Management Commitment

Top Management Commitment (TMC)		**Survey** *(Overall Mean)*	**Company** *(Overall Mean)*
TMC1	Acts as change leader	4.24	3.1
TMC2	Vision & mission echo the principles of lean thinking leader	3.94	3.1
TMC3	Inclination on quality rather than cost	3.63	2.8
TMC4	Resources and time allocation for Lean.	3.74	3.1
TMC5	Understanding of Lean activities and practices	3.65	3.2

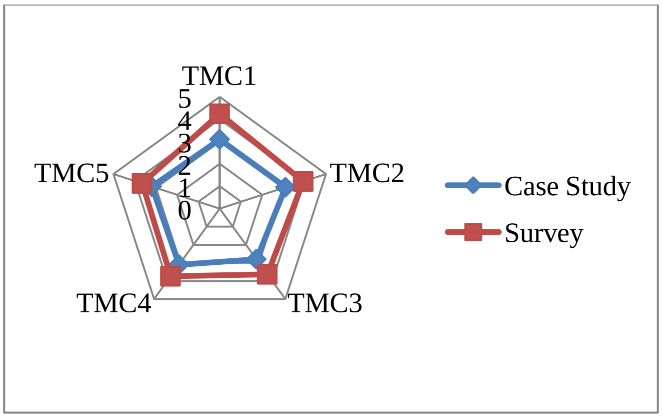


Figure 7-1: Assessment of Top Management Commitment

7.2.1.3.2 Human Resource and Change Management

The assessment of Human Resource and Change Management for lean practices collated on five point likert scale has been depicted in table 7-2. The case company is still working on change management and treating employee as partners. This is important as lean management is an exercise in change management. More needs to be done at human resource front as call centre are labour intensive. The employees hired have low skill levels as call centre work on low profit margins. The education and training activities are low as it's a challenge to arrange lean experts to provide training and education. The fear of negative feedback or loss of job prevents frontline staff from taking decisions without supervisor approval. Company is working on giving more authority and responsibility to front line staffers, where manager work just as facilitator. This is in tune with requirement of lean management which emphasis on employee engagement and involvement. The overall mean of the surveyed companies and case study Company for Human Resource and Change Management can be seen in radar chart in fig.7-2.

Table 7-2: Assessment of Human Resource and Change Management

Human Resource and Change Management (HRCM)		**Survey** *(Overall Mean)*	**Company** *(Overall Mean)*
HRCM1	Willingness and motivation for change.	3.63	3.2
HRCM2	Organisation culture is supportive of lean.	3.77	3.2
HRCM3	Employees as partners.	3.78	3.2
HRCM4	Trainings in lean tools, problem identification etc.	3.78	3.1
HRCM5	Trainings in interactive / social skills.	3.86	3.1
HRCM7	Multi skilled employees and cross functional teams.	3.79	3.2
HRCM9	Employees empowerment	3.30	2.8

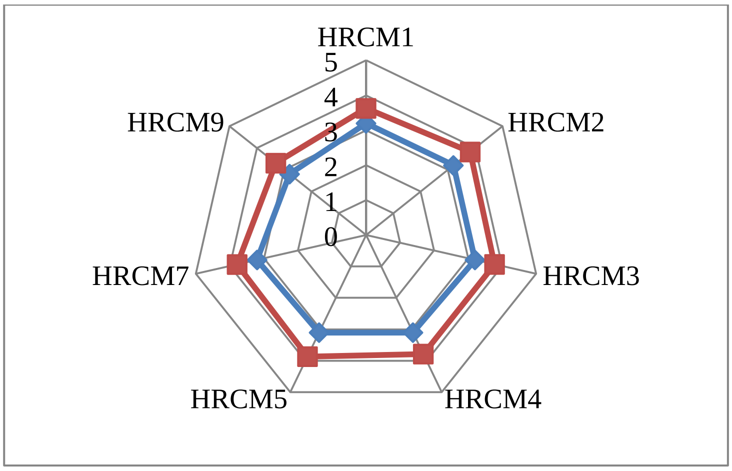


Figure 7-2: Assessment of Human Resource and Change Management

7.2.1.3.3 Customer Relationship Management

The assessment of Customer Relationship Management for lean practices collated on five point likert scale has been depicted in table 7-3 below. The case study company listens to voice of customer and captures feedback for the same. The customer database is maintained by the core client hence the case study company had less emphasis on maintaining database. Company is training its employee on soft skills to have better relationship between customer and employee. It is also reviewing its SLA's and redefining performance measure to have them on as per business goals and client rules. The overall mean of the surveyed companies and case study company for Customer Relationship Management can be seen in radar chart in fig. 7-3.

Table 7-3: Assessment of Customer Relationship Management

Customer Relationship Management (CRM)		**Survey** *(Overall Mean)*	**Company** *(Overall Mean)*
CRM1	Voice of Customer	4.05	3.8
CRM2	Customers' periodic surveys /feedbacks etc.	4.04	3.8
CRM3	Extensive customer service program.	3.98	3.7
CRM4	Comprehensive database of customers.	4.18	3.5

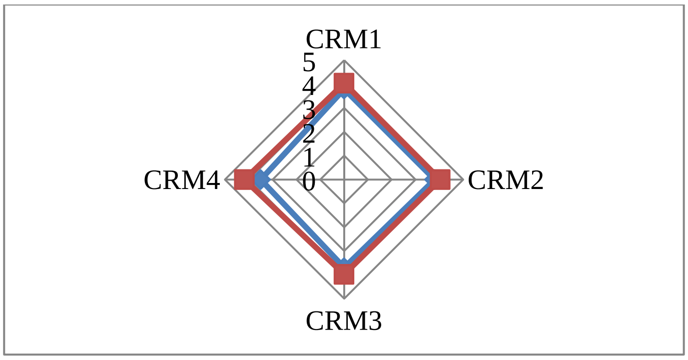


Figure 7-3: Assessment of Customer Relationship Management

7.2.1.3.4 Elimination of Waste

The assessment of Elimination of Waste for lean practices collated on five point likert scale has been depicted in table 7-4 below. The case study company works more on producing defect free services as it impacts productivity as well as customer experience. It has extensively adopted lean tools like VSM, root cause analysis etc for identifying and eliminating wastes in processes. The overall mean of the surveyed companies and case company for Elimination of Waste can be seen in radar chart in fig.7-4

Table 7-4: Assessment of Elimination of Waste

Elimination of Waste (EOW)		**Survey** *(Overall Mean)*	**Company** *(Overall Mean)*
EOW1	Current/future state analysis using VSM.	3.81	3.5
EOW2	Visualisation of process maps and updating them.	3.77	3.4
EOW3	Eliminating/reducing wastes	3.88	3.5
EOW4	Producing defect free services.	3.76	3.6
EOW5	Quality of Input	3.76	3.5

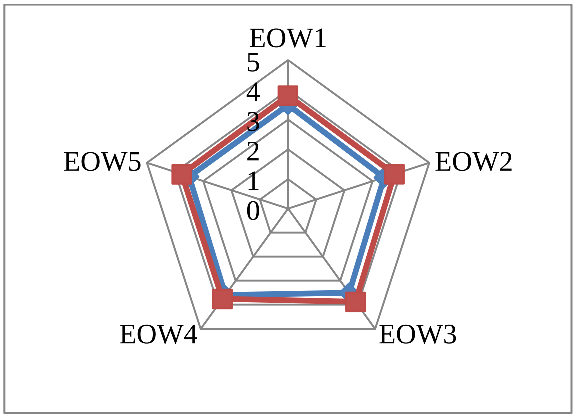


Figure 7-4: Assessment of Elimination of Waste

7.2.1.3.5 Continuous Process Improvement

The assessment of Continuous Process Improvement for lean practices collated on five point likert scale has been depicted in table 7-5 below. The case study company strives more on continuous process flow and meeting periodically to assess the improvements. The case organisation standardised the processes on the basis of type of customer demand. Standard script was also prepared to reduce the long scripts, irrelevant probing and unnecessary customer validation. It has adopted tools like fishbone diagram and Pareto analysis for continuous improvement. Still it is found wanting in continuous process improvement due to lack of training in lean tools and practices. Periodic meetings are not having much contribution from frontline staff. Thus they are needed to be encouraged to come up with ideas for improving and standardising processes. The overall mean of the surveyed companies and case company for Continuous Process Improvement can be seen in radar chart in figure 7-5.

Table 7-5: Assessment of Continuous Process Improvement

Continuous Process Improvement (CPI)		**Survey** *(Overall Mean)*	**Company** *(Overall Mean)*
CPI1	Periodic meetings to discuss continuous improvement.	3.98	3.4
CPI2	Processes have continuous flow	3.93	3.5
CPI3	Clearly defined and standardised processes.	3.94	3.3
CPI4	Measuring all key process metrics	4.00	3.3
CPI5	Structured, well defined action plan for problem solving and process improvement.	3.87	3.3
CPI6	Using continuous improvement tools	3.94	3.3

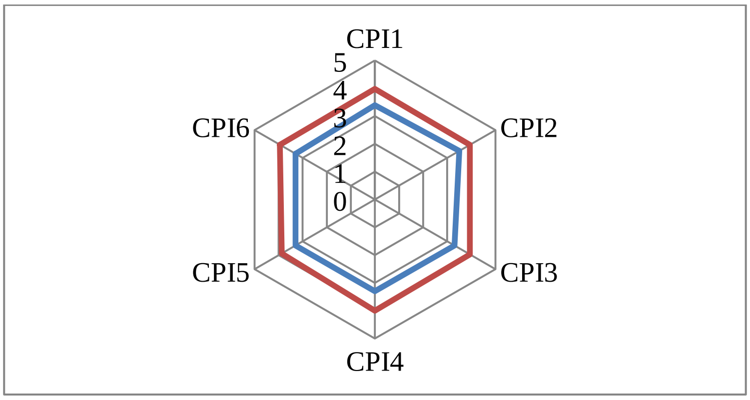


Figure 7-5: Assessment of Continuous Process Improvement

7.2.1.3.6 Supplier Management

The assessment of Supplier Management for lean practices collated on five point likert scale has been depicted in table 7-6 below. The surveyed companies and case company are found to be at same wavelength on initiatives. The case study company has little need of supplier management as it has very few suppliers. The client act as a major supplier of information related to services it provides. The overall mean of the surveyed companies and case company for Supplier Management can be seen in radar chart in figure 7-6.

Table 7-6: Assessment of Supplier Management

Supplier Management (SPM)		**Survey** *(Overall Mean)*	**Company** *(Overall Mean)*
SPM1	Suppliers as partners.	3.42	3.2
SPM2	Training programmes for suppliers.	3.32	2.9
SPM3	Supplier selection based on value addition and not only on cost.	3.47	3.2
SPM4	Extensive supplier management programme.	3.52	3.4

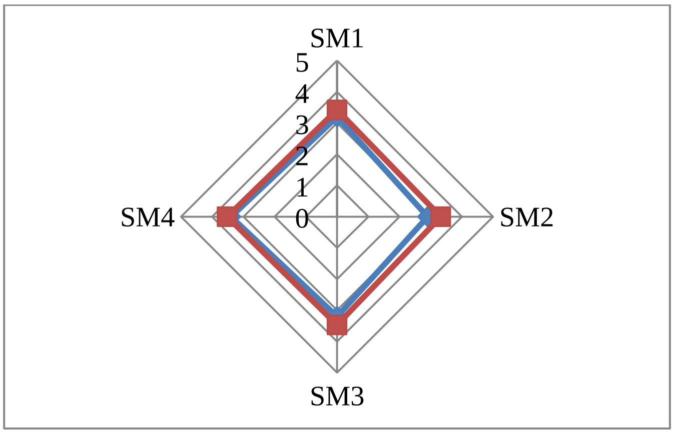


Figure 7-6: Assessment of Supplier Management

7.2.1.3.7 Information Technology and Knowledge Management

The assessment of Information Technology and Knowledge Management for lean practices collated on five point likert scale has been depicted in table 7-7 below. The case study company is providing timely and accurate information for fast and first time call resolution. It is still on the road of developing knowledge portal for capturing and sharing best practices. Company is aiming to share the captured information among different departments, thus helping in assessing the health of processes through call logs on one hand; on the other hand it can be used for staffing and training purpose too. The low skill level of frontline staff makes it essential to educate and train frontline staff in using the information system effectively. The same will help in reduction of redundant work and improving the skills of employees. The overall mean of the surveyed companies and case company for Information Technology & Knowledge Management can be seen in radar chart in figure 7-7.

Table 7-7: Assessment of Information Technology and Knowledge Management

Information Technology and Knowledge Management (ITKM)		**Survey** *(Overall Mean)*	**Company** *(Overall Mean)*
ITKM1	Locating and sharing information as needed	3.86	3.5
ITKM2	Managing accuracy, timeliness, relevance, quantity and form of information.	3.93	3.6
ITKM3	Using reliable & thoroughly tested technology.	3.86	3.3
ITKM4	Enhancing technological capability.	3.92	3.4
ITKM5	Enhancing the knowledge base for lean.	3.81	3.3
ITKM6	Developing new/innovative services and practices.	3.93	3.4
ITKM7	Transforming tacit knowledge into explicit organisational knowledge	3.81	3.4
ITKM8	Capturing , reviewing, standardising and sharing learning , best practices etc.	3.88	3.1

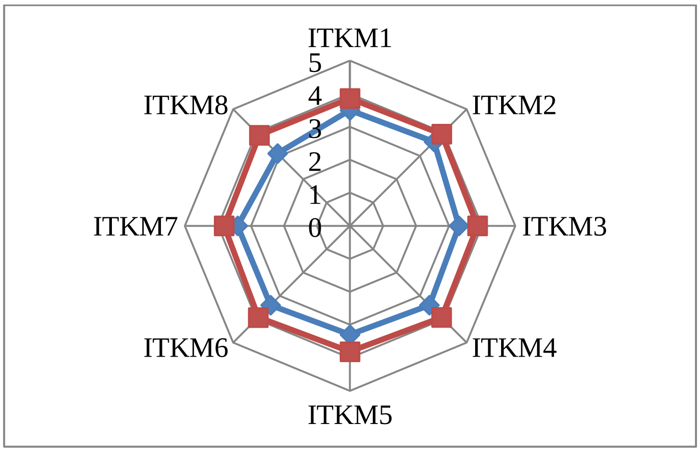


Figure 7-7: Assessment of Information Technology and Knowledge Management

7.2.1.3.8 Servicescapes

The assessment of Servicescapes for lean practices collated on five point likert scale has been depicted in table 7-8 below. The company provides comfortable, clean and ambient physical environment for comfortable working of employees. It is found wanting in applying ergonomics for better physical health of workers as the shifts are long and needs lot of sitting too. The overall mean of the surveyed companies and case company for Servicescapes can be seen in radar chart in figure 7-8.

Table 7-8: Assessment of Servicescapes

Servicescapes (SS)		Survey *(Overall Mean)*	Company *(Overall Mean)*
SS1	Comfortable, clean physical environment and ambient conditions.	4.11	3.6
SS2	Equipments, physical facilities, signboards etc. to educate and influence customers.	3.92	3.3
SS3	Physical layout, facilities etc. support uninterrupted flow.	4.03	3.4
SS4	Employees with pleasing and neat appearance for quality assurance.	4.02	3.5

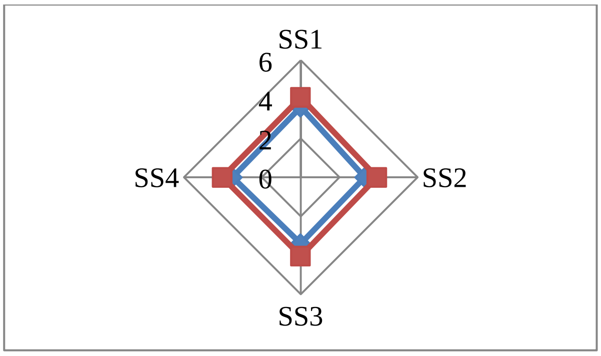


Figure 7-8: Assessment of Servicescapes

7.2.1.3.9 Operational Performance

The assessment of Operational Performance for lean practices collated on five point likert scale has been depicted in table 7-9 below. The table illustrates that top most Operational Performance initiatives for the surveyed companies are Quality, delivery and customer satisfaction. The case study company emphasise more on waste and cost reduction to enhance customer satisfaction. As the call centre works on low profit margin hence it stresses more on cost saving by means of waste reduction leading to enhanced customer satisfaction. The overall mean of the surveyed companies and case company for Operational Performance can be seen in radar chart in figure 7-9.

Table 7-9: Assessment of Operational Performance

Operational Performance (OP)		**Survey** *(Overall Mean)*	**Company** *(Overall Mean)*
OP1	Waste Reduction	3.81	3.5
OP2	Cost Reduction	3.80	3.5
OP3	Resource Utilisation	3.84	3.3
OP4	Quality	4.01	3.3
OP5	Delivery	3.95	3.2
OP6	Flexibility	3.74	3.2
OP7	Customer Satisfaction	3.94	3.3
OP8	Innovation	3.72	3.3

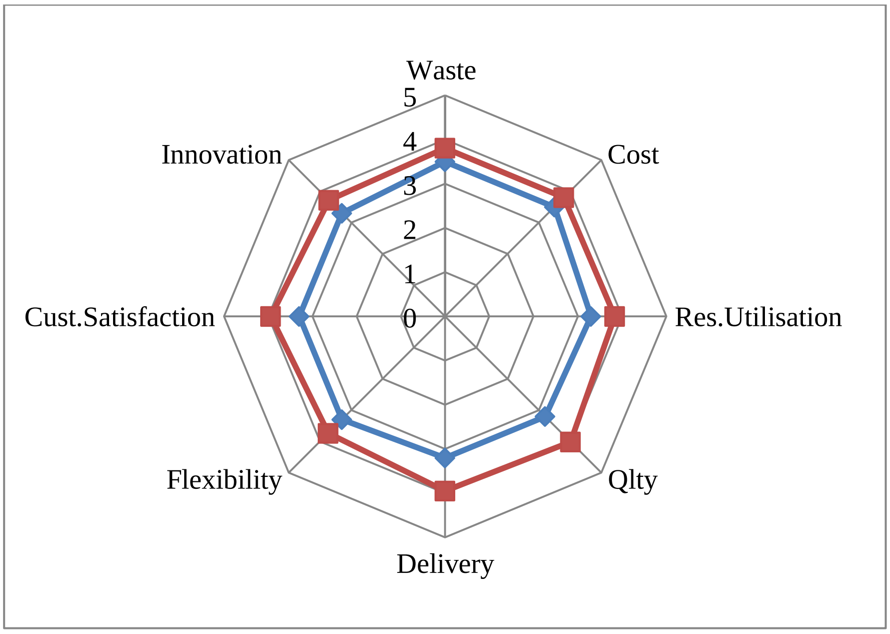


Figure 7-9: Assessment of Operational Performance

The data collected from the case study was further put in the model validated empirically by survey. The mean values of the lean pillars from the case study were put in the equation below:

OP= 0.293+0.282ITKM+0.221 EOW+0.151 SM+0.168 CPI+0.111 SS

OP (predicted) = 3.43

OP (case study) = 3.33

The mean value of operational performance from the responses by respondents is like the value predicted by the model. The small variation might be due to behavioural change on collecting the data face to face and filling the same on web link.

7.2.1.4 Recommendations

The case company is on the right track for lean implementation. The same has been imbibed in the culture through regular periodic meetings and discussions on continuous improvements. Though the case company was found wanting in soliciting more inputs from front line staffs. The NVA measurement system and quality audits had helped in identifying and eliminating waste. It also checks any deviation from the standards and work for the correction. Giving timely and accurate information to the front staff has improved their motivation leading to better employee satisfaction, but more needs to be done in HR field. The major challenge is lack of expertise, low skill levels of staff, high attrition rate, and anxiety regarding change, cost and time associated with adopting lean management. Thus transformation policy supporting change and catering to the people is the need of the hour.

Top management should continue developing organisational infrastructure. They should work towards implementing plans; setting up control measures to make certain that Lean improvements remain strongly aligned with business strategies. The company needs development of policies and reward system to empower employees. More accountability has to be accompanied with more authority and responsibility at the bottom in making decisions. Trainings needs have to be identified with emphasis on continuous up gradation of skills at each level. All managers and executives are needed to be educated and trained about lean management. The training needs to be structured and customised depending upon how the people will be involved in selecting and managing the lean implementation. Emphasis should be put on structured problem solving processes as people in call centre have low skill levels and are generally shy away from mathematical computations. Along with employees the company needs to amalgamate its business partners and suppliers into lean journey to get full benefits of lean.

The company was found wanting in capturing and sharing best practices. Organisation should work towards documenting the improved process, building a critical bunch of knowledge. Frontline staff should be encouraged to use their experience and knowledge for standardising and documenting the processes. This on one hand will add towards the learning of organisation & decreasing redundant work, on the other hand it will improve employee satisfaction. The company should strive to establish same level of service offerings at every location and at every touch point with customers to improve its delivery. The organisation should go for benchmarking within the sector. This will help the organisation to identify its core strengths which might be leveraged to grow business into new markets. Benchmarking would also aid in recognising the area still to work upon.

The following recommendations will certainly give leverage to the case company and will further add to its growth. The organisation should aim for stretch targets to reap the benefits of the lean foundation laid earlier.

7.2.2 Effect of Lean Practices Implementation in a Service Organisation

The case study was done in a NABH accredited super speciality hospital in north India. For technical reasons identity of the case organisation is not revealed. The hospital was looking for further quality improvement methodology after NABH accreditation as it was focusing on patient satisfaction, hospital delivery systems, problem identification and teamwork for quality assurance. The hospital had previously conducted a training programme on 5S and hence the employees had some basic knowledge about Lean. Some tenets of 5S and visual management had been adopted in the two laboratories. Seeing the benefits the management was interested in adapting lean practices more extensively. Hence they decided for going for further testing the waters by implementing lean for solving the problem of high TAT in their pathology department. The team for the study had a member of quality department from the case study organisation, senior technologist from the laboratory, a research scholar and a PG student. The team meetings were held weekly to discuss the progress. The aim of the study was not to check whether the proposed framework can be implemented in the organisation, but with an aim to assess the impact of lean tool implementation in the organisation with zero experience in lean.

The detailed case study has been a part of PG thesis; hence the data has not been shared here to avoid plagiarism. The PG student and researcher worked in tandem towards lean implementation under the guidance of a faculty member from a NIT (National Institute of Technology) having experience in lean adoption. The case study gave the researcher an opportunity to assess how the initiatives mentioned in the framework are helpful in improving the bottom-line of the organisation with no experience in lean.

7.2.2.1 About the Organisation

The study discussed below is of 200 bedded super specialty hospital located in north India offering medical assistance to number of patients every day. Its mission is to provide most advanced medical services to its patients primarily focusing on humanity, compassion and concern. The hospital is one of the kinds in north India and caters to multiple states. The hospital aims to provide 'Affordable Care with Human Touch' to all sections of the society focusing on patients, hospital delivery systems, problem identification and teamwork. The Quality department is responsible for bringing forward the innovative ideas relating to safety of patient & quality services, feasibility study, planning, implementing & control process[3].

7.2.2.2 Problem Statement

The hospital was concerned over higher turnaround time (TAT) of the two wings of its pathology department i.e. the haematology and the biochemistry lab. It is a well-known fact that patient outcomes are adversely affected by delays in diagnosis (Kenagy et al., 1999). Thus TAT is an important performance parameter for any health care center or laboratory. In the study the TAT was calculated as time elapsed from specimen accept

[3] This case study is accepted and is under publication in International Journal of Health Care Quality Assurance

time in laboratory to the time the final reports are authorized by the consultant. Table 7-10 depicts the targeted TAT of the labs.

Table 7-10: Targeted TAT for Haematology Lab and Microbiology Lab

Tests	**TAT**
Complete Blood Count (CBC)	120 minutes
CBC+ Hemato lymphoid	150-180 minutes
CBC + PBF	180 minutes
Targeted TAT for Microbiology Lab	
Blood Sugar : F/PP/R	180 minutes
Urine Sugar : F/PP/R	180 minutes
RFT	210 minutes
LFT	210 minutes
Lipid Profile	210 minutes
Fluid Chemistry	210 minutes
Other	240 minutes

The laboratory received blood or body fluid samples from collection chamber located two floors above the case laboratory for OPD and from seven wards located in the hospital for IPD. The samples from ward constitute almost 10-15% of the total samples investigated by the laboratories. Delivery of test samples to the laboratories was done manually by the lab boy from collection chamber and by ward boy/nurses from IPD.

7.2.2.3 Implementation of Lean Practices to Improve TAT

The lean methodology was adopted including Gemba walk followed by value stream mapping (VSM), root cause analysis and finally giving the recommendations for improvement. The study was done in first half of year 2016.

The study started with involving the staff in lean journey. A formal session explaining the lean thinking to the laboratories' staff was conducted and how their suggestions can contribute towards the study was also described in the session. Each of the haematology and biochemistry laboratories had three technicians and two consultants with two technicians and a consultant working at one time. They have shift rotations and a technician is shared with other laboratories too.

The hospital had previously done a kaizen event and has adopted few tenets of lean. The laboratory was practicing 5S (Sort, Set in Order, Shine, Standardize and Sustain). The materials were placed at their designated places. The tested samples were kept in special racks so that can be easily tracked if they are required for slide staining. The machines were duly calibrated each morning and staffs clean their workstations before leaving in evening. The SOP's of lab were displayed at appropriate place for reference by technicians. The test requisition slips and vacutainers for sample collection were of different colour in each laboratory as per the test to be done. It provides the visual cues for the test to be done and made it easier for lab boy to deliver the samples to the lab it is intended for. The specimen delivery was done manually by delivery boy at regular intervals of 15-20 minutes from specimen collection room.

7.2.2.4 Study and Analysis

The team implemented Lean approach using the following four steps:

a. Gemba Walk
b. Mapping Value Stream
c. Identifying the waste
d. Minimising/Eliminating the waste using root cause analysis.

a. *Gemba Walk:* The study was initiated with Gemba walks to understand the processes at the laboratory. As a result of Gemba walk the team decided to focus on CBC tests and exclude other tests at the haematology lab because of their low volume. Another realization was that the data captured by Hospital Information System (HIS) is incomplete and many times time stamp was over written as the test sample moves from one process step to other. This meant dearth of operational data from historical sources to measure the expanse of the waste and TAT problems. The team decided to go for direct observations of process steps, breaking them into activities and recording whatever was happening using paper, pencil and stopwatch. The data from HIS though divulge the trend that the traffic was higher in morning session i.e. from 9 A.M. to 1P.M and Monday being the peak day.
b. *Mapping the Value Stream:* The team observed the processes at both the labs and drew the flow chart of the same. The flow chart acted as an input in drawing value stream map and analyzing the processes. The flow chart was followed by time study of the process in order to determine the constitution of process times,

activities/tasks being done and potential areas of improvement. Data was collected for a period of well over 90 days. In total around 210 valid samples; 120 from Haematology lab and 95 samples from Bio Chemistry were recorded and studied covering the whole value chain after removing outliers and invalid samples. Standard times for the each process step were obtained by removing outliers and taking average time of the recorded samples. Average TAT for CBC test in Haematology lab came around 189.93 minutes. If a slide had to be prepared and analyzed, an additional 30-40 minutes was added to the CBCA process cycle time. Average TAT for Biochemistry lab came around 244 minutes. The flow chart and time study served as an input in constructing the VSM and for further analysis.

c. *Identifying the Waste:* The team learned more about the process, tasks and activities by drilling down the data collected. The activities in current VSM were segregated into value added, NVA (non value added) and ENVA (essential non value added) activities after brainstorming session of team members along with input from staff members. Out of seven lean wastes mentioned in the literature only three wastes were identified in the present study i.e. waiting time, transportation and motion. It was found that in both the labs the total percentage of NVA activities was more than 70%.

d. *Minimizing/Eliminating the Waste:* Pareto chart and root cause analysis tools were used to do thorough analysis of the NVA activities. The NVA activities were studied and causes for the same were identified through observations and discussion. These causes/factors were segregated into NVA and ENVA activities. Taking motivation from Pareto principle also known as the 80/20 rule; which states 80% of the effects comes from 20% of the causes (Pimblott, 1990) the team decided to focus on vital few i.e. few wastes which are causing maximum impact. Pareto chart was used to ascertain these vital few .It was seen from Pareto chart that the two factors:

   i. Non availability of the lab boy to deliver reports to consultants and back to lab for reviewing and authorization; and
   ii. Timely, non-availability of consultant to review the report

are causing 80% of the problem of high TAT in the Hematology lab .Timely, non-availability of consultant to review the report was the main cause of high

TAT in the Biochemistry lab. Using cause and effects diagrams and why- why analysis the team strived to found the root cause of these vital few factors and came up with the recommendations as given below.

7.2.2.5 Results and Recommendations

As seen from the above discussion the factor non availability of lab boy to carry reports from Hematology lab to consultant room was the main cause of waiting. Why-Why analysis led to finding that lab boy was not dedicated to lab only and had other official duties too. These duties prevented him from reporting at the lab in required interval. One alternative was appointment of dedicated lab boy but this would have led to increase in man power expenses. The causes identified for factor non availability of consultants to review the reports were non avoidable. The team recommended for making clearer role and responsibilities of consultants. On further brainstorming and discussion the question arises why reports need to travel? On probing further the team recommended to shift the printer attached to the CBC machine installed at the lab to the resident room. As per the study done average Machine Generated Report (MGR) waiting to go for review in residents' lab per day for the samples is 74.03 minutes and this step can be eliminated by simply shifting or having a new printer at the residents' lab. The hospital will be saving around Rs. 100K annually by simply shifting the printer from CBC lab to consultant chamber as per our cost-benefit analysis report or Rs.80K annually if in case a new printer is installed at the chamber. This will reduce the TAT to 90 minutes and with slides to 120 minutes.

The team also discussed and analysed the case of eliminating the paper work all together except handing over the hard copy of the report to the patient. Review, remarks and final authorisation all will be done online thus removing the bulk waiting and transportation time. This will further reduce TAT to 80 minutes. Hospital Information System (HIS) needs to be modified for the same but it was not the proprietary system of hospital. Hence, the management has decided to take this issue with the concerned vendor to analyse its cost and feasibility.

As per the time study of Biochemistry lab, the reports wait on an average 106.37 minutes to be signed or authorised by consultant. The consultant is advised to visit and authorise reports in time span of 30-45 minutes. The visual indicator (Andon) was recommended in the consultant chamber which will alert the consultants in their chamber that batch of reports are ready for review/authorisation. The batch size of report is not recommended as it might lead to long waiting time on low demand days. The above recommendations will bring down the TAT to 182 minutes.

The future state VSM was drawn taking into account the recommendations suggested above. Future state value stream map is in an interim stage between the current state map and the ideal state. From current state map the team spotted the steps which can be eliminated or improved upon. Finally, the researcher had annotated the changes in the future state. This Future state VSM will act as the current state and can be used as a baseline to plan the next series of changes.

As per the above recommendations, the printer at the consultant's chamber was configured to get the print out of the report at the chamber only. Study was done on 50 samples in the month after it. It showed marked improvement in TAT as it averages out to 103.8 minutes. The study in Biochemistry lab on 30 samples in month after adopting Andon showed TAT of 192.34 minutes, which is little above the targeted.

7.2.2.5.1 Further Recommendations Suggested

It was observed that technicians are often busy in doing clerical work like entering data in computer or attending the phone calls. This not only decreases their efficiency but also hampers the TAT. The researchers recommended for appointment of separate staff for the clerical work. The two labs may share the staff as both the labs are adjacent. One may also go for part time staff, as the need is high during the peak time from 9-1pm. This will lead to further reduction in TAT especially in biochemistry lab, as majority of test results are entered manually in the system.

It was observed that report delivery counter was located in pathology department at the basement while blood sample was collected on first floor. This was creating transportation waste as sample travelled two floors and confusion for the customers regarding report collection. The staffs too get disturbed as often patients come in lab and ask for their report. On the recommendation of the team the management agreed to have both counters at same place. The sample collection room along with report delivery centre was shifted to ground floor as the room was vacant there. This reduced the travelling time for sample and unnecessary confusion of patient’s too.

During the study the team collected the data manually as none of necessary information was available on the HIS. The manual collection was time consuming and error prone. The team suggested for implementation of an automated bar coding system .This will help in tracking the sample easily, end of generating IDs at multiples point and automatic data collection. The team advised to train at least one lab person on data system so that periodically data can be analysed and root causes can be investigated. Thus information technology and knowledge management plays an important role in accurate data collection and proactive approach towards process improvement.

The team had some problems initially due to reluctance of senior people in adopting new methodologies. Intervention of quality department helped in data collection and implementation of few suggestions. Thus the need is to educate the senior employees about latest improvement methodologies and create culture of improvement. The team members of hospitals and lab staff need to be educated in quality techniques; their suggestions solicited and implemented leading to empowerment of employees.

The study acted as a motivator for the management to infuse lean management as a way of thinking as a daily practice among the employees. The hospital is planning to improve their discharge process implementing lean tools. It was observed that hospital gives more preference to customer satisfaction, quality of care and prompt delivery. In future it is aiming in enhancing its ability to meet customer requirements, learning and training, implementation of process improvement activities.

As the case is of lean implementation in the organisation with no experience of lean hence one cannot assess the level of lean implementation and compare the same with the survey results. The study established the importance of lean initiatives as discussed in the proposed framework. It emphasised on the role of management commitment towards successful implementation. Lean philosophy cannot be successfully deployed until it has commitment from top management in terms of time, resources and knowledge. Lean solicits cultural change as it on one hand it creates learning environment; on the other hand it empowers employees for problem solving. Employees feel motivated when suggestions for improvement were solicited from them. More needed to be done to make them partners in process improvement along with required trainings? Elimination of waste using tools leads to process improvement saving lot of time and costs. The physical layout also adds towards the service quality. Management of accurate and timely information is a necessity for sustaining the improvement and also for further improvement. The vendor of HIS has to be enrolled in lean initiative to take it further and adopting as way of life. The study proved the lean implementation helps in improving service process resulting into cost reduction and enhanced customer satisfaction.

7.3 Conclusion

The studies depicted how lean tools can be used to reduce the waste in services leading to cost saving for the organisation and improved efficiency. It emphasised on the role of people and management in successful adoption of lean methodology. Thus it gels with the findings that though top management commitment and HR and change management might not have statistical significance in lean implementation, but they act as an enabler for lean implementation. People are the backbone of any service industry. Their support and motivation are essential for implementing other facets of lean management. Both the organisations adopted lean initiatives to eliminate waste in the processes aiming towards customer centric organisation. It also established the importance of information system for timely and accurate availability of information for sustaining and improvement process and also for training of people.

These studies ascertained the need of creating customer centric organisation as the way forward to sustain in global competitiveness. Hence, every decision needs to be measured in form of its contribution towards value creation for customer.

CHAPTER 8: RECOMMENDATIONS AND CONCLUSION

The learning of the research, views of the respondents, case studies and discussion from the experts have helped to come out with few salient features observed in lean services. These have helped the researcher to give certain recommendations which may help the organisations at different stages of lean implementation.

It is easy to get started with relatively simple Lean tools which can effectively remove cost and delays from processes. One needs to see the readiness of the organisation, engage people, mobilise the resources and provide control to sustain lean improvements. Systems view of the operations of the organisations has to be kept in mind, making sure that the puzzle pieces continue to fit together.

An organisation with no experience in lean should consider *bottom up approach* as a viable option for lean implementation. Bottom up approach encompasses *taking up small, low-cost, low-risk projects and building up on its success as learning curve improves*. As they are starting to improve and get control over their operations, not seeking to be best in class yet starting small makes sense. Visits to other organisations who are involved in Lean may be planned to see how they have adapted the lean practices to their work culture and business needs.

Need is to set up a cultural infrastructure having top management engagement, line executives involvement and dedicated resources for successful adoption of improvement initiatives. One needs to *develop a simple, participative problem-solving strategy where everyone gets together at a place, looks at the concerns, and comes to decisions on tactical actions that they have ownership over*. An executive having major influence in the organisation is selected as lean champion. Some basic information about the current status is to be documented so that the key decision makers are all starting from the same point. Learning how to capture the important data within process in services will help to achieve significant Lean results. Data needs to be compiled regarding financial status of the organisation, information on customer satisfaction, departmental health, deployment of people etc. It will help to establish the gaps between current and desired performance. One can start the lean journey with external consultant or few internal experts which can grow as you move down the line. They will be there to aid in creating and supplying the environment, culture and structure for the change.

Though stages of lean implementation moves not just with mere passage of time but also with the establishment of practices and readiness of organisation towards lean. Stages are defined as period of lean implementation by an organisation. As per Womack & Jones (1995) the enterprise wide lean implementation takes 3-6 yrs. Hence below three is taken as beginner, 3-6 as intermediate and above 6 as advanced. Some specific recommendations are given keeping in mind the various level of lean implementation by the service organisation In nutshell the recommendations as per the stages are depicted in table 8-1 followed with detailed description below.

Table 8-1: Recommendations for lean implementation as per the level of the organisation

	Beginner	**Intermediate**	**Advanced**
Recommended Focus Areas			
Management Commitment	x	x	x
Key Influencer engagement	x	x	x
Developing Culture & Infrastructure	x	x	x
Education and Training	x	x	x
Project Prioritization	x	x	x
Information and Knowledge Management	x	x	x
Key to Measure	x	x	x
Servicescape	x	x	x
Rewards and Incentive Policy		x	x
Empowering people		x	x
Vertical lean alignment		x	x
Sharing best practices		x	x
Innovation			x
Lean as a way of work			x
Balanced approach			x
Tools			
Eliminating/Reducing Waste and WIP	x	x	x
Kaizen	x	x	x
Visual Management and Value Stream Mapping	x	x	x
Standardisation	x	x	x
Reducing Process Complexity		x	x
Benchmarking		x	x
A3 Sheets, Heijunka			x

8.1 Recommendations for Implementation of Lean Initiatives in a Service Organization:

8.1.1 Level of Lean Implementation (Beginner: 0-3 yrs)

The initial stage is all about laying foundation for the lean implementation, gaining the support of people, overcoming resistance. The aim is to visualise the commitment of management and communicating the same within the organisation to create readiness for the lean. One needs to start small and build on its success. Engage the process owners as they know best about the work, create system view to get a holistic view by educating and training people on fundamental lean practices and tools. Share the success to motivate people and overcoming resistance towards change.

8.1.1.1 Management Commitment

The speed, quality, and cost advantages provided by Lean are the drivers of Return on Invested Capital. Highly visible top management involvement and support is necessary for success of any improvement initiative, so with lean Management commitment towards lean act as an enabler for successful lean implementation. Training with the staff will help to see management commitment towards making lean happen. This will motivate people at lower levels to overcome their resistance and adopt lean initiatives.

8.1.1.2 Engaging Key Influencers

Lean is not just about tools, it’s a philosophy of striving for perfection through continuous improvement taking people as partners. It’s an exercise in cultural and attitude change too. The organisation beginning the lean journey should start with a series of carefully selected, strategically important projects so the change is visualised by people and motivates them to go for Lean. Key influencers who exert formal or informal power in the organization should be engaged first as it increases the chances that the lean implementation will progress smoothly and receive support among the people. Influencers also work towards building alliances and seeing that the projects being chosen for improvements are connected with management’s priorities.

8.1.1.3 Developing Culture and Infrastructure

Services are labour intensive and it's essential to energise people energized about Lean as they act as an ambassador and promoters influencing lean initiatives especially the people at borderlines. Organisational culture should be supportive of lean management. The only way to reduce people's resistance and get their acceptance towards lean implementation is to engage them in determining what has to change and how to implement lean management for improving processes. Frontline people, along with external and internal experts, process owners, managers etc should be included in the team as lean decisions are influenced not only by the people who are the process owners and likely impacted by lean, but also by the team dynamics. As our findings also state multi-skilled employees should be encouraged to work in cross cultural team to help visualising the processes as systems. As the people's understanding of the improvement improves, chances of smooth and successful lean implementation will increase.

Services being labour intensive people should pay more stress on communication, involvement, and commitment. Collaboration and partnership is the key in successful lean implementation as through discussions people realize the differences in the way they each think the process works. This realization helps in giving a system view and opening the doors for identifying wastes.

8.1.1.4 Project Prioritisation

The first-wave projects must be prioritised and selected on the basis of shareholder's value and business priorities. The initial projects should have a sponsor, who is respected within the organization; have a say and good rapport with top management. Success of lean implementation makes them the advocates and organisation may promote or reward these early adopters. As a result, the peer pressure and success results will make other business units to seek out for lean implementation.

8.1.1.5 Education and Training

One needs to start small and build on its success to sell lean thinking extensively within the organisation. Training should be planned, structured and customised depending on the level of participants and complexity of the tools, with emphasis on applications in services. The approach should be to introduce people with fundamentals and only with essential tools of process improvements using simple language which doesn't intimidate people and then introduce new tools or methods as a way to add more power and rigor to the exercise. One may teach lean tools and practices without giving it name of "lean". This will help in dealing with the anxiety and resistance that comes with having to be trained in a new terminology, tools, etc. As findings suggests training in interactive/ social skills are also needed as often customers are co producer in services.

8.1.1.6 Key to Measure

Decisions should be taken on what to measure and how to measure. Measuring all key process metrics is an important step of journey of continuous improvement as per the findings of the research. The data collected should help in identifying the underlying causes of the problem along with results impacted. The measurement system should measure both hard savings and soft savings, which delighted customers. The plans for improvement should be communicated before taking actions and results should be shared as widely as possible to gain momentum.

A data collection system (especially for VSM) is generally not present in services processes. People should be educated and trained to understand the importance of data. People understand the work process better than the experts, so they should be engaged in developing data collection forms and in gathering the data itself. Employment engagement is one the key initiatives for effective HR management. Improvement in service processes becomes more rewarding because people get to exercise their creativity, and gains come relatively quickly.

8.1.1.7 Kaizen Workshops

Kaizen generate high degree of creativity, energy and results by the pressure to rapidly produce tangible results. The Kaizen produces immediate gains in productivity and quality which helps in substantiating the push towards lean. Hence, all improvement events should be well scoped in advance so one can get visible results from the Kaizen and accept that the return on investment will be worthwhile.

8.1.1.8 Implementing the Lean Tools

In services, work is largely invisible. Invisible work can't be improved: the need is of visual management, based on data. Understanding the work flow and evaluating WIP (work in progress) are prerequisites for implementing Lean to reduce waste and improve speed. Diagrams, process maps, process flow diagrams, visual management, value stream mapping etc have to be used extensively to make invisible work visible. This will help in raising awareness in staff about how their work and physical layout of their work area affects quality and speed; which is missing generally in services. Research findings also root for using VSM to visualise and analyse the current and future state. Findings also advocates for continuously updating the process maps.

Visual Management and Value Stream Mapping

The visibility of work flow helps to extensively develop willingness to challenge the status quo among people. Willingness and motivation to change is necessary for successful change management. People start questioning the necessity of each activity, waiting time and identifying the complexity of processes. Tools like VSM offer the ability to see cost and lead time reduction opportunities where it was never visible before. It will give the ability to distinguish between standards and practices that are necessary & meaningful and those that are adding cost & have no benefits to the customers.

A visual workplace helps in communication, make status and performance of the process immediately visible to any one walking into the work area. It also provides feedback to team members, supervisors, managers making it possible for all employees to contribute to continuous improvement. It is best to have cross functional team as eventually it brings with it a very strong focus on entire service lines giving it a holistic view thus helping in effective lean implementation. It also helps in improving understanding of one's contribution towards the end goal and also in understanding the importance of work of other people involved in whole value chain. It aids in breaking down barriers and enhancing working as a team toward common customer-centred goals.

Eliminating/Reducing Waste and WIP

Eliminating waste is one of the most important pillars of lean management. Invisibility and amount of WIP makes service processes slow. Work in services may have to wait for more than 90% of its process time due to high amount of WIP. This doesn’t help the customers and also creates a huge amount of waste in the process. Visibility of process followed by root cause analysis and other problem solving tools offers a better way to control WIP.

Lean tools like pull reduces the WIP and waste, hence improving the financial return. It is easier to adopt pull in services but difficult to control WIP if it’s the people who are in waiting. One can use any of the three principles of pooling, triaging and back up capacity to control congestion arising due to demand variation in services.

In services the offering is just not the service outcome but also of emotions or matching customer expectations. To satisfy it one need to have back up capacity and engage customers with human touch. “What if” simulations of the relative impact of waste, WIP, lead time cost versus benefits of reducing setup time, complexity, service offerings and improving quality, delivery will help to take decisions in the right direction.

Standardisation

Standardization has the advantage of boosting cost reductions without cutting on any customer services. Clearly defined and standardised processes are one of the key initiatives of continuous improvement. .In services one can go for standardising the processes wherever human emotions are not playing major part. Standardisation helps to satisfy a variety of customer needs at low cost. Lean thus becomes a powerful competitive advantage as organisations are able to deliver more uniform and better quality service to their customers regardless of variation in location or shift or provider.

8.1.1.9 Information and Knowledge Management

Information and technology system plays multifaceted role of enhancing communication, imparting education and training, managing partners, improving processes and managing relationship with customers as suggested by the research findings. It decreases waste of waiting and motion in service processes. It also enhances the decision making power of front line staff leading to faster resolution of complaints.Technological advancements intended to improve productivity may change service process designs enabling not only more self-service activities, but also more activities performed without direct customer contact. Online web portals may be used effectively for training and education purpose.

8.1.1.10 Servicescape

Physical environment should be made conducive towards the need of customers and employees. Change in physical layout may reduce lot of motion and transportations waste. Signs, symbols etc helps in educating and directing the customers. It also influences customers' evaluations of other factors determining perceived service quality.

At the finishing of this stage basic infrastructure for lean is in place, with managers committed, people educated, trained and practicing the basic tenets of lean principles. Progress might be slow due to overcoming resistance and training of staff on lean. Few low hanging fruits may give some quick benefits. At this stage one may not receive huge returns on costs but major progress will be in working culture and environment. One must have patience and need to build on the work done.

8.1.2 Level of Lean Implementation (Intermediary: 3-6 yrs)

Once firms have gained some experience in lean and have spent considerable time (3 -6 yrs) they can be termed as intermediate firms. These firms have adopted lean tools like VSM, standardisation, root cause analysis etc standardising and stabilising their processes. These firms have mainly adopted lean management as project initiatives and are now working to use it extensively. These organisations should work from the goal of meeting basic customer needs to towards the goal of hard core metrics like enhancing earnings per share. The organisation strives for sustaining the fundamentals achieved wiz: Service excellence and should work towards creating a high performance culture and enhancing revenue growth. At this stage changes can be adopted extensively as seeing the benefits the manager's mindset has changed from "protecting my ground" to "doing everything viable to serve the customers in better way", thus voice of customer act as basis for every lean initiatives undertaken.

8.1.2.1 Enhance the Infrastructure

Organisations should continue to develop a strong infrastructure. One should work on putting in place processes that assure the sustainment of enhanced business results over the long term. Evaluation should be done of organization preparedness, supportive and receptive power towards such a major change. Management should devote sufficient time and resources towards lean management.

One may start training on complex statistical activities and lean tools like A3 sheet, complex VSM, Heijunka etc which will further add to the improvements already done. At this stage organisation should seek that trainings should encompass all management levels and to each employees directly or indirectly involved with lean management. One should also work on retaining and building human capitals in service organizations having a high level of turnover is equivalent of consistently asking to change machine parts in manufacturing. This is especially true for the workforce trained on lean thinking else the results and momentum will deplete if the ownership often changes hand. Organisation should make certain that Lean improvements remain strongly aligned with business strategies.

8.1.2.2 Project Prioritisation

The future potential projects are evaluated based not only on its potential impact on customers but also on their impact on internal effectiveness, efficiency, operational and business performance and stakeholders' value. One should work on how to convert the benefits achieved by implementing lean into monetary gains.

8.1.2.3 Reducing Process Complexity

Lot more importance should be given on Lean goals working towards eliminating or reducing complexity, simplifying the process and increasing process velocity. Reduction in complexity in any process will enhance operational performance by reducing time, costs, massive waste and improving speed and quality.

Complexity in any process can be identified using complex VSM, which graphically shows complexity in process. Eliminating the extra offerings which do not meet the investment done for them will earn greater savings than simply improving the process.

8.1.2.4 Vertical Lean Alignment

One needs to amalgamate the business partners and suppliers into lean journey to get full benefits of lean management. Research findings also advocate training programmes for suppliers to engage them in lean implementation. Working across organisational boundaries also helps in building credibility and develops confidence and comfort level with the lean tools. It also act as an eye opener giving to better understanding of each others' business operations and eventually impacting the external customer in positive manner.

8.1.2.5 Empowering People

People are the major asset for any service organisation but they are also the major cause of variation. Organisation should go beyond involving and works on empowering employees to act, suggested by our findings of research too. Establishing the policy of "see problem, fix it" allows the employees to exercise their discretion and initiative to use their time more efficiently and resolving issues more quickly. Employees are given more authority with power of readily availability of accurate information. The managers act as facilitators and supporters for the frontline staff.

8.1.2.6 Rewards and Incentives Policy

The organisation needs to revamp its reward and incentive programmes as rewards, praise and recognition are the strongest motivators towards any change initiative. Praise and recognition is the most important thing one can give to employees for the organisation who cannot easily use money as a reward. Human psychology also states that recognition in front of peers is the biggest incentive, many times bigger than financial incentive.

8.1.2.7 Sharing Best Practices

At this stage one should work towards coordinating the results of various projects, to accelerate learning and improvement, to examine and evaluate the value-creation potential across different functional areas of the organization. This knowledge mass should be used regularly used towards enhancing learning and removing redundant work thus reducing the learning curve. This can be easily done with the power of Information, Technology and Knowledge Management. Organisation should be able to consistently provide high quality and reliable services to remain competitive in the market. To achieve this, the lean initiatives towards organisation wide improvement should be amalgamation of sharing best practices and establishing same level of service offerings at every location and at every touch point with customers.

8.1.2.8 Benchmarking

These different initiatives will work in tandem and many times in parallel for process improvement. One may go for benchmarking within the sector to identify their core strength which might be leveraged to grow business into new markets. Similarly benchmarking would also aid in recognising the area still to work upon.

The organisation should have stretch targets to reap the benefits of the foundation laid in first stage. One had worked on enhancing the skills and knowledge of its employees and involving suppliers in their lean journey. People are given more autonomy and managers acts as a support system. Lean had been established as an organisation wide mission. Thus the organisation at this stage should strive towards becoming self running and self regulating organisation.

8.1.3 Level of Lean Implementation (Advance: More than 6 yrs)

8.1.3.1 Lean as a Way of Work

The organisations working with lean for over six years can be termed as advance lean users. At this juncture the organisations have adopted lean philosophy striving for perfection and it becomes the way of everyday working. Lean experts are taken back and being rotated into managerial positions.

The organisation works for improvement outside organisational boundaries, imparting education, coaching and training in lean for business partners, suppliers and even customers. They may go for holding symposia where suppliers and business partners can learn from each other. This will lead to creation of lean enterprise leading to unmatched competitive advantage.

8.1.3.2 Innovation

The organisation at this stage should go for transformational change thus developing or innovating new way of doing things. As an endeavour towards it, organisation needs to works diligently to integrate voice of customer into their service design decisions. This will also help businesses to identify opportunities which they couldn't identify themselves towards new service offerings, in technology advancements etc. The changing requirements of the organization due to market dynamics should be kept at the top and one needs to improve and expand their skill sets catering to it. This is one of the key to not only sustain in market but enhance business performance too.

8.1.3.3 Adopting the Balanced Approach

Organisation at this stage must balance two contrasting forces: the force of the market and the force of complexity. The force of market drives up the complexity by forcing introduction of new services and broadening the service offering. On the other hand force of complexity directs for simplification of the service offerings due to cost pressures. The decision should be finding the optimal point, which is the one that maximizes economic profit.

The Lean should be fully integrated with organisation structure and business flow to attain its full potential.

8.1.3.4 Benchmarking

One may go for benchmarking with the best across industries in lean to identify their position, what are they best at and for identifying the areas for improvement.

At this stage the growth might become stagnant and one may need to invest more to reap high hanging fruits. Improvements at this stage will give cutting edge competitive advantage. One should not become complacent but should continue on the journey of continuous improvement. Innovation or new ideas are the way ahead for enhancing service offerings. Developing partnerships with industry leaders and learning across industries is the way ahead.

Lean in services is also about change in culture and behaviour. This transformation cannot be brought about only by structure and system. Commitment of top management should be visible to motivate people for the change. It is necessary at all stages to engage and mobilize the influencers. Sharing best practices shortens the learning curve, reduces redundant work and act as a motivator towards improvement as suggested by research findings too.

Flatter management with shared goals and values, creating alignment and understanding of strategy, fostering a collaborative mentality, cross functional teams with multi skills people, measuring the value at the touch points, reducing service failures, rewarding through group incentives are imperative to accomplish successful lean transformation in the service environment.

8.2 Conclusion

The World Bank has stated that the service sector's contribution in poverty alleviation is greater than that of agriculture and manufacturing. The sector contributed around 61 per cent towards India's Gross Domestic Product in 2015-16, 51 per cent of foreign direct investment and 28 per cent of employment growing (CII & KPMG, 2016). It is growing strongly at approximately 10 per cent per annum, making India the second fastest growing services economy in the world. Thus service sector is the dominant driver of India's economic growth. This sector's vibrancy can be ascribed to liberalization. Henceforth the Government initiatives of "Make in India" and "Digital India" are expected to have a positive impact on the growth of services in India.

The important outcomes of the present research study can be summarised as follows:

Lean is being adopted extensively in Indian service for last 6 years. Most of the Indian service companies are fervent in implementing process improvement methods mainly due to intense competitive environment. Though still many of the companies are at nascent stage of implementation. Extensive adoption of cause and effect analysis, Pareto chart, standardisation, visual stream mapping, and cross functional teams suggests that these tools are widely being used in Indian services. It strengthens the belief that those lean practices which are related to waste identification/elimination and identifying the root cause are widespread in services. The service organisations are making efforts to map the processes and activities. This not only help in identifying waste or non-value added activities but also help in identifying root cause of the many service, operations, HR and other related problems and planning the improvement actions.

In the survey it was also found that practices like one piece flow are used by very low percentage of respondents. Limited understanding and lack of experience in lean have led to moderate adoption of lean practices like Visual Management, 5S and Kaizen. The practices of cause and effect analysis and Pareto chart are highly used. Indian services might be using them before adopting lean formally.

Indian service industry perceives operational excellence as the foremost reason for adopting lean. Possibly the demanding, conscious customer and cut throat competition have forced them to look at processes and operations. Thus they are looking at “waste” in their processes to improve service quality enhancing customer satisfaction. Services have been found lacking in having the system view and standardized processes citing demand variety and customer presence in the processes. Value stream mapping has helped in visualizing the whole value chain and identifying waste. This has led to standardization of processes and improving the performance. Hence it seems rational for Indian services to implement lean.

As majority of the respondents have adopted lean in last three years hence one can say that lean is still not widespread in Indian services. They are still novice at it.

Barriers to Lean Implementation

Mere implementation of lean tools without understanding the lean philosophy and integrative system will not gives long term gains. Management’s apprehension of the impact of lean adoption on work culture and on limited resources, anxiety and resistance regarding change, cultural issues, lack of management commitment, insufficient funds or cost associated with lean, lack of awareness and education about its potential benefits, lack of skills on management part and workforce are major challenges in adopting lean.

People resist changes as they love status quo and have anxiety regarding loss of power and change in the way of doing work. Old traditional thinking and business models like ‘bureaucratic’ or excess regulation also impedes towards adopting new methodology. Lack of understanding and involvement of management in lean shows their lack of commitment which further enhances people’s resistance to change. Insufficient education and knowledge about lean and its benefits also increases anxiety regarding cost and times associated with lean which act as a major barrier for its implementation.

These barriers could be overcome with forthright planning, transformational leadership, exemplary communication, sharing of best practice in nutshell having a shared vision. Successful lean implementation needs visible management commitment in terms of allocation of resources including appropriate funds and time. Education and training of employees in lean practices along with having HR policies and mechanisms empowering and giving autonomy are another essentials for successful lean implementation. Culture of sustainable and proactive improvement, organisational structure involvement of all, knowledge transfer and management, monitoring and evaluating performance plays an important role in successful lean benefits.

The identified 18 lean service frameworks from literature were found wanting in many respects. Majority of them were project specific, sector specific catering to the need of developed economies. The same were empirically investigated for their applicability in Indian services. Also, there is scarcity of literature exemplifying the performance improvement through lean implementation in services. Thus, the need was identified for a comprehensive framework having extensive list of lean practices and relating lean with performance improvements. This research is an initial study trying to investigate the relationship between lean services and operational performance improvement, lean and business performance improvement, operational performance and business performance.

Regression analysis was carried out to assess these relationships. The model suggested that lean practices of Elimination of Waste, Continuous Process Improvement, Supplier Management, Information, Technology and Knowledge Management and Servicescapes results in improvement in operational performance. The practices are responsible for more than 76% variance in operational performance. The impact of lean practices and operational performance on business performance was found to be partial. The lean practices of Top Management commitment, Continuous Process Improvement and

Information, Technology and Knowledge Management have significant positive effect on profits. The lean practices of Elimination of Waste and Information, Technology and Knowledge Management have statistically significant effect on market share. The lean practice of Elimination of Waste has statistical significant effect on customer base. The lean practices of Top Management commitment, Supplier Management and Information, Technology and Knowledge Management have statistically significant effect on annual sales turnover. Operational performance improves profits and customer share.

Implementation of lean practices positively impacted operational performance of Indian services by reduction in waste and costs, improvement in resource utilisation, service quality, delivery, customer satisfaction, flexibility and innovation. Thus, one can conclude that adoption of lean affect performance in services in positive manner. As the effect of lean and operational performance has been partial it means there is some other factors too like market dynamics, new entrant and competitiveness impacting business performance which is beyond the scope of operations management.

The present study explored that as the major focus while implementing lean is on operational excellence; hence lean practices related to these principles are extensively used in Indian services. Services have not significantly implemented practices related to top management commitment and human resource & change management. It appears that comprehensive planning at enterprise level for enhancing performance embracing all lean practices is still not of utmost importance in Indian Services. This might also be due to the fact that lean is being adopted in silo manner. Very few organizations have gone for enterprise wide application

Timely, accurate and cost effective delivery of information is paramount impacting efficiency, productivity, cost and customer satisfaction. Services being knowledge work learning and upgrading skills need to be continuous, demanding capturing and sharing of best practices etc. Improvement in employees' skill is mandatory for successful implementation of lean practices.

Contextual factors such as size, types and age also influence the performance. The study has included firms from four service sectors of different sizes and types. It was evident that lean is being adopted more by large organisation as compared to small. This may be due to fact of having sufficient resources for effective implementation of lean. The proposed framework was developed irrespective of size of the companies including both small and large firms.

8.3 Contributions of the research

The contribution of this research may be summarised in the following manner:

- Comprehensive literature review related to lean / lean services. The review revealed 18 existing lean service frameworks/models apart from identifying the various research gaps.
- Reliability and validity of the 18 existing lean services framework was investigated using a survey instrument. Moreover, it was found that none of the frameworks are appropriate for the Indian services. Only nine were uni-dimensional. Majority of them were project specific, sector specific catering to the need of developed economies. Hence their applicability to different service sector was to be investigated further Thus there was need for the new framework.
- A framework for lean services was proposed and validated. The proposed framework can facilitate the practitioners to comprehend clearly what comprises lean services. Framework will serve as a valuable guideline for both academicians and practitioners in adoption or review of their lean implementation assisting them in achieving operational excellence.
- A sector wise comparison was done to get more insight into status of lean in Indian Services. It was found that Indian services are at nascent stage of adoption of lean services with majority of companies lying in the bracket of 0-3 yrs of lean adoption. Lean practices of cause and effect analysis, Pareto analysis and standardisation, are being adopted services. Over all the services sector emphasis more on quality (mean=4.01) followed by delivery (mean=3.95) and customer satisfaction (mean=3.94).
- To the best of the knowledge, this is initial study conducted in Indian service sector to investigate the relationship between lean practices, operational and business performance. Thus, the findings of this study present valuable knowledge in process improvement/operational excellence/lean from Indian

service sector point of view. The findings will assist academicians, practitioners, policy makers and organisations who desires to promote and support lean in India services.

- Applicability of proposed framework has been verified with two case studies in different services arena, thus establishing the relevance of lean in services.

- From the learning of literature and case studies certain recommendations for implementation of lean initiatives for the service organizations at different level of lean implementation are given which will serve as the guidelines in their endeavour towards lean implementation.

8.4 Limitations of the Research

Like all other research studies, this study has a number of limitations which can be addressed in future research.

- The study encompassed only four service sector in Indian Services. Though these sectors contribute significantly towards the growth of services, still the findings should be generalised carefully.

- The study is limited to Indian Service Sector. The results may differ in different countries and in economies

- The study has not taken contextual factor like service process type or firm age which may impact the implementation of lean.

8.5 Future Research

Few recommendations are put forward for future research.

- The proposed framework has been validated in four Indian service sectors. A similar study can further be taken across other service sectors which have not been covered in this study to validate the proposed framework. Similarly future research can replicate the study in service context other than India.

- Relationships between lean practices and business performance have not come out very clearly in the present study. A longitudinal study is required to assess the relationship of lean practices on business performance.
- As the activities are interdependent so are their effects of improvement. It is difficult to measure which lean practices impact which performance measure. Further research is need of the hour to explore exactly which lean practices has resulted in what performance improvement. This will help the services to customise their lean implementation as per their need of improvement.
- It was evident from the study that very few small organisations have implemented lean. Further research is required to analyse the specific reasons for the same and exploring the possibilities of lean implementation in them.

8.6 Implications of the research

Firstly, the present study has provided empirical evidence that lean implementation in services will lead to enhancement of performances. Thus the study has tried to break the myth that lean is only beneficial to manufacturing and not beneficial or difficult to adapt in services. The need is to establish organisation wide belief that implementation of lean will not only assist in improving the performance but will also give a cutting edge over the non-implementers. It will help in cost efficiency, customer satisfaction and sustaining the cut throat competition.

The management should form strategies to implement lean and vision should be shared with employees at all level. The management should strive to share and increase awareness, education and training about lean in services. Policies and reward system need to be revisited for empowering employees and defining their role and responsibilities in extensive implementation of lean. Lean team having representative from all departments must be constituted to form the roadmap and developing strategies for lean implementation.

It may be understood that the proposed framework will act as a guideline towards lean implementation in services. It will facilitate the practitioners/academicians/managers to comprehend clearly what comprises lean services and to appreciate the performance enhancement through lean implementation in services. The framework might require few modifications to suit the particular organisation requirements. All lean practices may not have the same level of implementation in a particular sector. The selection of lean practices and tools should be made carefully to suit the requirements of the organisation. Similarly the ‘what’ of performance will remain the same but “how to” measure it need to be adapted as per the type of services and requirements of the organisation.

Service sector are advised to carry out benchmarking studies to augment the knowledge and understanding about the lean methodology. The lean implementation may be started by adopting tools which do not involve high cost like visual controls and standardisations. After reaping the benefits from it the organisation may adopt other lean practices along with them to uplift the benefits to next level. The small players may establish alliances and collaborations with multinationals organisations who have implemented lean successfully.

The study had contributed in developing understanding the concept of lean practices. Lean implementation will help the Indian services to focus on remodelling their operational strategies, improving their performance and facilitating their sustainment in this era of competition.

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APPENDIX I

Reliability Analysis Tables for the Existing Lean Service Frameworks

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.782	.784	7

Item Statistics

	Mean	Std. Deviation	N
Linear flow arrangement : Flexible Cells	3.37	1.045	92
Small production batches: a single unit	3.07	1.036	92
Rapid preparations	3.30	1.014	92
Grouping of tasks by workstation: Conform to given takt time	3.53	.907	92
Versatile personnel	3.47	.988	92
Quality assurance	4.02	.949	92
Preventive Maintenance	3.89	1.043	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.522	3.065	4.022	.957	1.312	.111	7
Item Variances	.997	.823	1.093	.270	1.328	.011	7

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
24.65	21.152	4.599	7

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.873	.874	10

Item Statistics

	Mean	Std. Deviation	N
Optimize the flow of products & services.	3.90	.961	92
Provide processes for seamless & timely transfer access to pertinent data & information.	3.92	.842	92
Provide technologies for seamless & timely transfer & access to pertinent data & information.	3.85	.769	92
Optimize the capability & utilization of people.	4.05	.817	92
Implement integrated product & process development teams.	3.83	.872	92
Develop relationships based on mutual trust & commitment.	3.85	.971	92
Continuously focus on the customer.	4.38	.796	92
Promote lean thinking at all levels.	3.99	.989	92
Continuous process improvement.	4.33	.800	92
Maximize stability in a changing environment.	3.70	.935	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.979	3.696	4.380	.685	1.185	.048	10
Item Variances	.772	.592	.978	.386	1.652	.021	10

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
39.79	36.078	6.006	10

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.852	.852	7

Item Statistics

	Mean	Std. Deviation	N
Elimination of waste	4.18	.925	92
Zero defects	3.80	.940	92
Pull	3.60	1.049	92
Continuous Improvement	4.22	.887	92
Multifunctional Teams	3.83	.968	92
Decentralization of responsibilities	3.77	.891	92
Vertical Information system	3.61	.889	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.859	3.598	4.217	.620	1.172	.063	7
Item Variances	.878	.787	1.100	.313	1.397	.013	7

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
27.01	22.780	4.773	7

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.869	.869	5

Item Statistics

	Mean	Std. Deviation	N
Identifying, enhancing & implementing value	4.01	.896	92
Effective management of supplier relations & information flow.	3.73	.813	92
Elimination of waste	4.16	.905	92
Appropriate matching of service capacity to customer-driven demand	4.10	.813	92
Continuous Improvement (Kaizen)	4.28	.869	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.057	3.728	4.283	.554	1.149	.044	5
Item Variances	.740	.661	.819	.159	1.240	.006	5

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
20.28	12.139	3.484	5

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.842	.845	6

Item Statistics

	Mean	Std. Deviation	N
Elimination of zero-value activities	3.87	.975	92
Continuous improvement	4.33	.772	92
Multifunctional teams	3.79	.920	92
JIT delivery	3.63	.958	92
Suppliers involvement	3.51	.955	92
Flexible information system.	3.74	.837	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.812	3.511	4.326	.815	1.232	.079	6
Item Variances	.820	.596	.950	.354	1.594	.020	6

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
22.87	16.488	4.061	6

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.774	.777	5

Item Statistics

	Mean	Std. Deviation	N
Waiting time at specific points in processes.	3.63	.980	92
Patient/ Customer satisfaction	4.34	.788	92
Referral management	3.38	.947	92
Process mapping	3.99	.858	92
Fulfilment of targets and policies.	3.96	.769	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.859	3.380	4.337	.957	1.283	.134	5
Item Variances	.762	.591	.961	.369	1.624	.027	5

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
19.29	9.990	3.161	5

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.918	.919	10

Item Statistics

	Mean	Std. Deviation	N
Leadership	4.21	.806	92
Functions	3.76	.776	92
Value Streams	4.10	.742	92
Anchors a) People	4.09	.794	92
Anchors b) Processes	3.99	.791	92
Anchors c) Partners	3.82	.851	92
Anchors d) Promotions	3.60	.927	92
Anchors e) Problem Solving	3.98	.798	92
Lean Thinking	4.10	.852	92
Results	4.18	.740	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.982	3.598	4.207	.609	1.169	.039	10
Item Variances	.655	.548	.858	.311	1.567	.009	10

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
39.82	37.757	6.145	10

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.891	.892	8

Item Statistics

	Mean	Std. Deviation	N
Understanding demand and capacity	3.95	.803	92
Understanding value	4.17	.779	92
Having a process view	3.92	.815	92
Linking activity to the Strategy	4.04	.837	92
Strong committed leadership	4.15	.851	92
Communication strategy	4.01	.777	92
Training and development	4.15	.784	92
Steering group and project team	3.87	.880	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.034	3.870	4.174	.304	1.079	.014	8
Item Variances	.667	.604	.774	.170	1.281	.004	8

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.27	24.244	4.924	8

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.913	.914	9

Item Statistics

	Mean	Std. Deviation	N
Leadership	4.26	.810	92
Cultural Change	3.83	.872	92
People Management	4.07	.862	92
Partnerships	3.63	.946	92
Processes	4.04	.837	92
Product/Service Results	4.08	.815	92
Policy Deployment	3.90	.878	92
Waste Reduction	4.16	.905	92
Root Cause Analysis	4.13	.815	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.011	3.630	4.261	.630	1.174	.037	9
Item Variances	.742	.656	.895	.238	1.363	.006	9

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
36.10	35.430	5.952	9

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.893	.893	8

Item Statistics

	Mean	Std. Deviation	N
Top Management Commitment	4.35	.844	92
Employee Engagement	4.16	.816	92
Team Work	4.30	.781	92
Training and Learning	4.11	.870	92
Voice of Customer	4.36	.764	92
Value Stream Mapping	4.11	.818	92
Focus on Flow	3.97	.805	92
Focus on Levelling	3.78	.875	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.143	3.783	4.359	.576	1.152	.040	8
Item Variances	.676	.584	.765	.181	1.310	.004	8

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
33.14	24.782	4.978	8

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.912	.913	8

Item Statistics

	Mean	Std. Deviation	N
Process Improvement	4.16	.788	92
Waste identification and elimination	4.12	.912	92
Problem Solving	4.04	.837	92
People and partner	3.91	.847	92
Voice of Customer	4.29	.749	92
Value Stream Mapping	4.04	.824	92
Kaizen	4.12	.888	92
Heijunka Scheduling	3.73	1.007	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.053	3.728	4.293	.565	1.152	.029	8
Item Variances	.739	.561	1.013	.452	1.805	.020	8

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.42	29.302	5.413	8

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.905	.904	8

Item Statistics

	Mean	Std. Deviation	N
Top Management Commitment	4.39	.825	92
Value for stakeholders.	4.10	.839	92
Focus on value stream	4.13	.828	92
Cultural and organisational development	3.92	.905	92
Training	4.04	.824	92
Value Stream Mapping	3.97	.883	92
Kaizen (Continuous Improvement)	4.16	.917	92
Lean assessment	3.91	.991	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.079	3.913	4.391	.478	1.122	.025	8
Item Variances	.771	.679	.981	.302	1.444	.011	8

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.63	29.598	5.440	8

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.935	.936	6

Item Statistics

	Mean	Std. Deviation	N
Customer service requirements analysis	4.01	.858	92
Process description and modelling	3.85	.889	92
Value Stream Mapping	3.98	.902	92
Service performance measurement	3.92	.802	92
Optimisation & service performance improvement	4.05	.830	92
Continuous Improvement	4.22	.849	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.005	3.848	4.217	.370	1.096	.016	6
Item Variances	.732	.642	.813	.170	1.265	.004	6

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
24.03	19.922	4.463	6

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.930	.930	8

Item Statistics

	Mean	Std. Deviation	N
Focus on Customer	4.42	.759	92
People	4.13	.828	92
Process	4.08	.842	92
Technology	4.04	.797	92
Shared Services	3.76	.856	92
Knowledge Management	3.79	.955	92
Continuous Optimization	4.08	.855	92
Efficiency Focus	4.04	.797	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.043	3.761	4.424	.663	1.176	.042	8
Item Variances	.702	.577	.913	.336	1.583	.010	8

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.35	30.119	5.488	8

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.962	.962	17

Item Statistics

	Mean	Std. Deviation	N
Transformational Leadership	4.12	.810	92
Willingness to change	4.20	.788	92
Emotional Competence	3.75	.979	92
Satisfaction with change	3.76	.817	92
Relational Competence	3.67	.891	92
Effective Communication	3.97	.845	92
Tools & Techniques Training	3.92	.855	92
Information Seamless Flow	3.86	.909	92
Material Seamless Flow	3.74	.875	92
People Seamless Flow	3.74	.936	92
Lean Sensei (Mentor / Teacher)	3.83	.933	92
Value Stream Achievements	3.79	.932	92
Trust Building	3.90	.915	92
Emotional Commitment	3.64	.956	92
Lean Values	3.92	.917	92
Technical Innovation	3.88	.850	92
Inter Organisation Achievement	3.79	.920	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.852	3.641	4.196	.554	1.152	.022	17
Item Variances	.795	.621	.959	.338	1.545	.009	17

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
65.49	142.099	11.921	17

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.950	.951	10

Item Statistics

	Mean	Std. Deviation	N
Value Stream Mapping	3.92	.986	92
Standardize processes	3.99	.871	92
Continuous Improvement	4.17	.897	92
Senior Management Support	4.05	.953	92
Create Flow	3.86	.846	92
Waste identification and elimination	4.04	.937	92
Structured Knowledge Sharing	3.68	.937	92
Quality Circles	3.63	.958	92
Structured Problem Solving	3.82	.937	92
Heijunka Scheduling	3.63	1.024	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.880	3.630	4.174	.543	1.150	.036	10
Item Variances	.876	.716	1.049	.333	1.465	.010	10

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
38.80	60.423	7.773	10

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.935	.935	11

Item Statistics

	Mean	Std. Deviation	N
Organization value and culture	4.04	.824	92
Knowledge management	3.78	.875	92
Technology management	3.85	.851	92
Capacity and availability management	3.78	.810	92
Causal analysis and resolution	3.88	.823	92
Continuous improvement	4.13	.880	92
Organizational training	3.96	.811	92
Supplier agreement and management	3.68	.851	92
Customer connection	4.05	.869	92
Value stream	3.95	.894	92
Visual control	3.68	.960	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.890	3.685	4.130	.446	1.121	.023	11
Item Variances	.739	.656	.922	.266	1.406	.006	11

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
42.79	54.078	7.354	11

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.952	.951	14

Item Statistics

	Mean	Std. Deviation	N
Employee commitment & understanding	3.97	.931	92
Employee training	3.88	.888	92
Management commitment and understanding.	4.21	.846	92
Infrastructural elements	3.55	.856	92
Customer value	4.17	.833	92
Identify waste.	3.91	.885	92
Flow	3.85	.949	92
Standardisation	4.00	.864	92
Level and balance workloads	3.80	.905	92
Zero Defects	3.80	.975	92
Pull	3.76	.918	92
Visualization	3.68	.925	92
Multifunctional employees	3.79	.908	92
Continuous improvement.	4.18	.864	92

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.898	3.554	4.207	.652	1.183	.037	14
Item Variances	.805	.695	.950	.256	1.368	.006	14

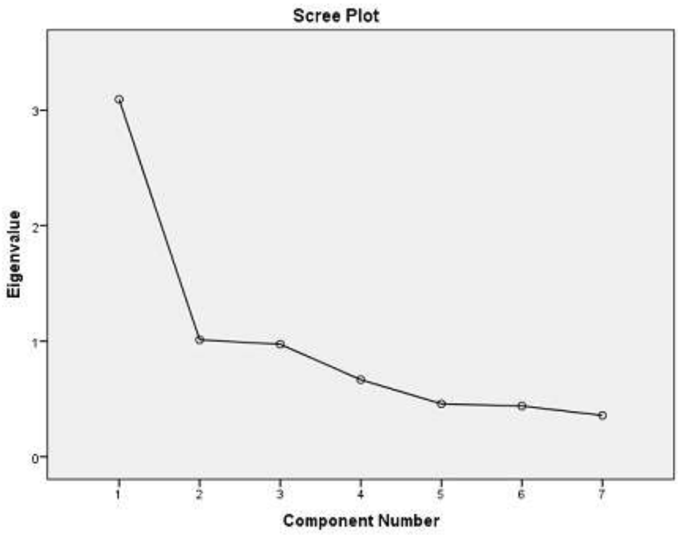
Scale Statistics

Mean	Variance	Std. Deviation	N of Items
54.58	96.774	9.837	14

Factor Analysis of the Existing Lean Service Frameworks

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.767
Bartlett's Test of Sphericity	Approx. Chi-Square	168.945
	df	21
	Sig.	.000



Rotated Component Matrix[a]

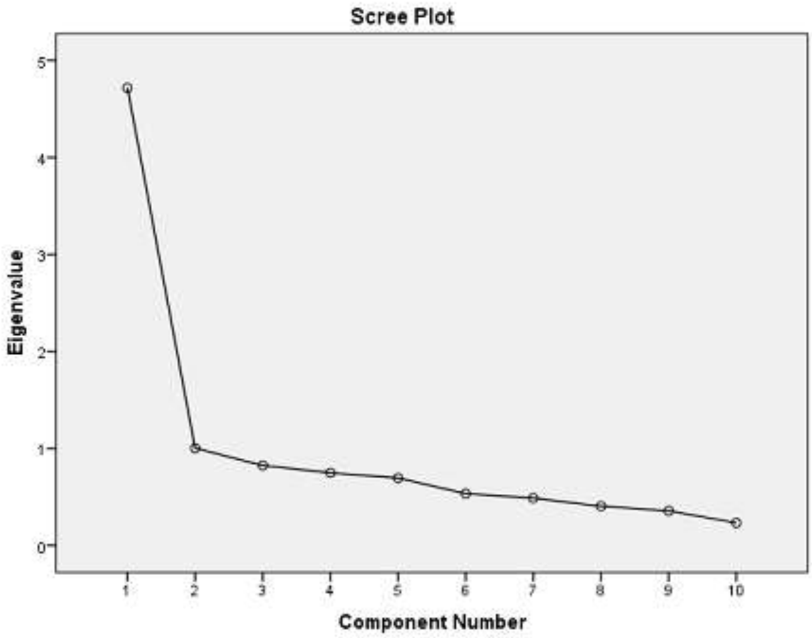
	Component	
	1	2
Linear flow arrangement : flexible cells	.388	.494
Small production batches: a single unit	.843	-.122
Rapid preparations	.097	.774
Grouping of tasks by workstation: Conform to given takt time	.645	.462
Versatile personnel	.150	.835
Quality assurance	.600	.310
Preventive Maintenance	.619	.432

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 3 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.851
Bartlett's Test of Sphericity	Approx. Chi-Square	350.732
	df	45
	Sig.	.000



Rotated Component Matrix[a]

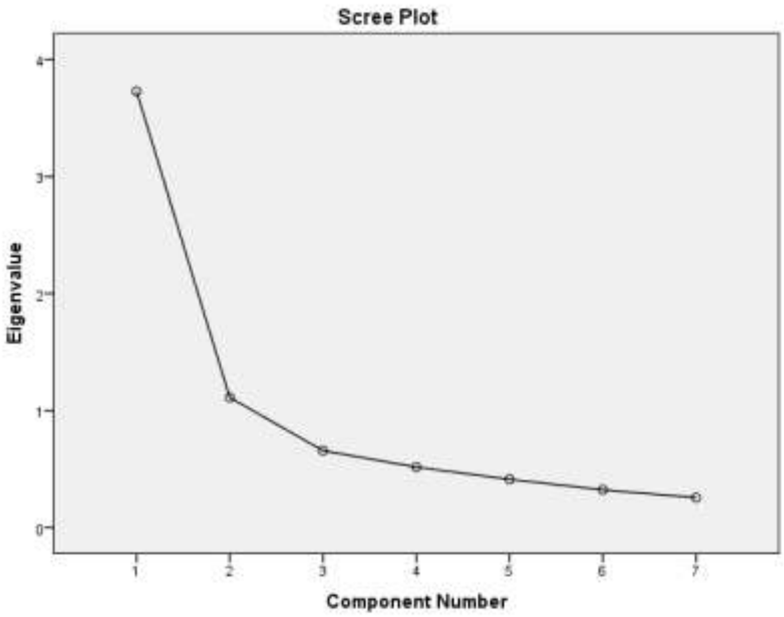
	Component	
	1	2
Optimize the flow of products & services.	.621	.440
Provide processes for seamless timely transfer access to pertinent data & information.	.191	.689
Provide technologies for seamless & timely transfer access to pertinent data &information.	.094	.874
Optimize the capability & utilization of people.	.345	.556
Implement integrated product &process development teams.	.433	.586
Develop relationships based on mutual trust commitment.	.301	.563
Continuously focus on the customer.	.546	.488
Promote lean thinking at all levels.	.777	.296
Continuous process improvement.	.860	.083
Maximize stability in a changing environment.	.659	.281

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 3 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.816
Bartlett's Test of Sphericity	Approx. Chi-Square	267.798
	df	21
	Sig.	.000



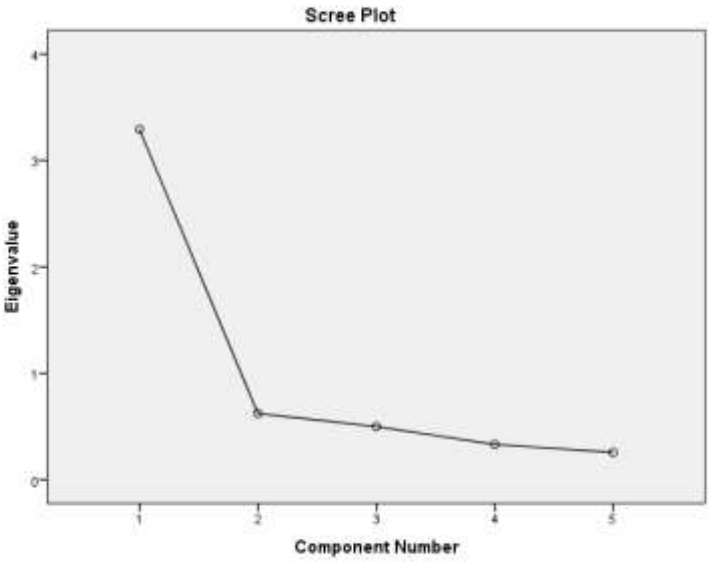
Rotated Component Matrix[a]

	Component	
	1	2
Elimination of waste	.811	.137
Zero defects	.811	.115
Pull	.650	.365
Continuous Improvement	.803	.228
Multifunctional Teams	.555	.509
Decentralization of responsibilities	.312	.857
Vertical Information system	.086	.911

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 3 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.819
Bartlett's Test of Sphericity	Approx. Chi-Square	216.317
	df	10
	Sig.	.000



Component Matrix[a]

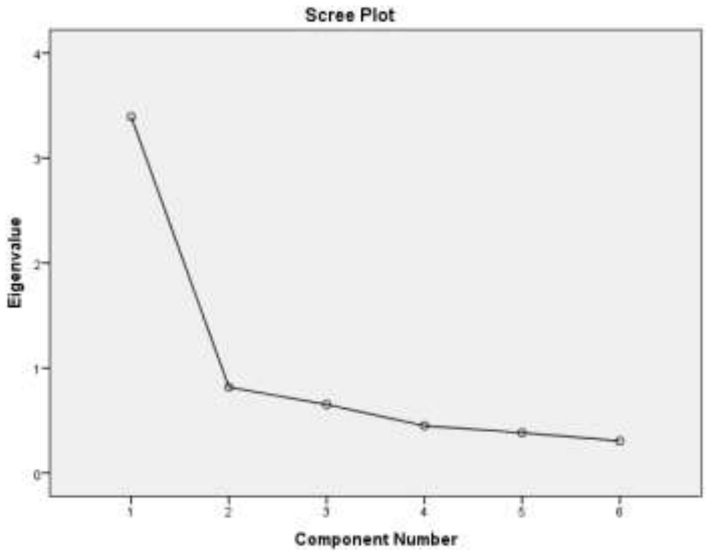
	Component
	1
Identifying, enhancing & implementing value	.765
Effective management of supplier relations & information flow.	.823
Elimination of waste	.876
Appropriate matching of service capacity to customer-driven demand	.784
Continuous Improvement (Kaizen)	.805

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.827
Bartlett's Test of Sphericity	Approx. Chi-Square	207.656
	df	15
	Sig.	.000



Component Matrix[a]

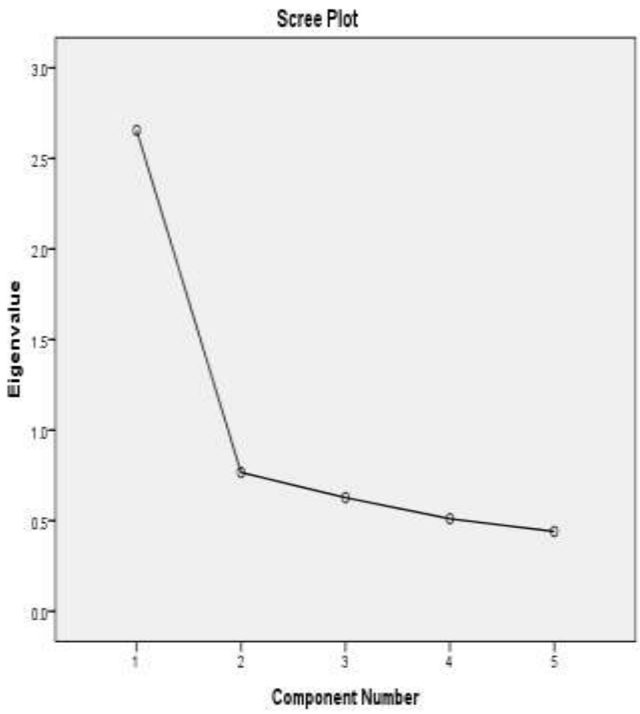
	Component
	1
Elimination of zero-value activities	.732
Continuous improvement	.771
Multifunctional teams	.637
JIT delivery	.750
Suppliers involvement	.828
Flexible information system.	.780

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.804
Bartlett's Test of Sphericity	Approx. Chi-Square	110.400
	df	10
	Sig.	.000



Component Matrix[a]

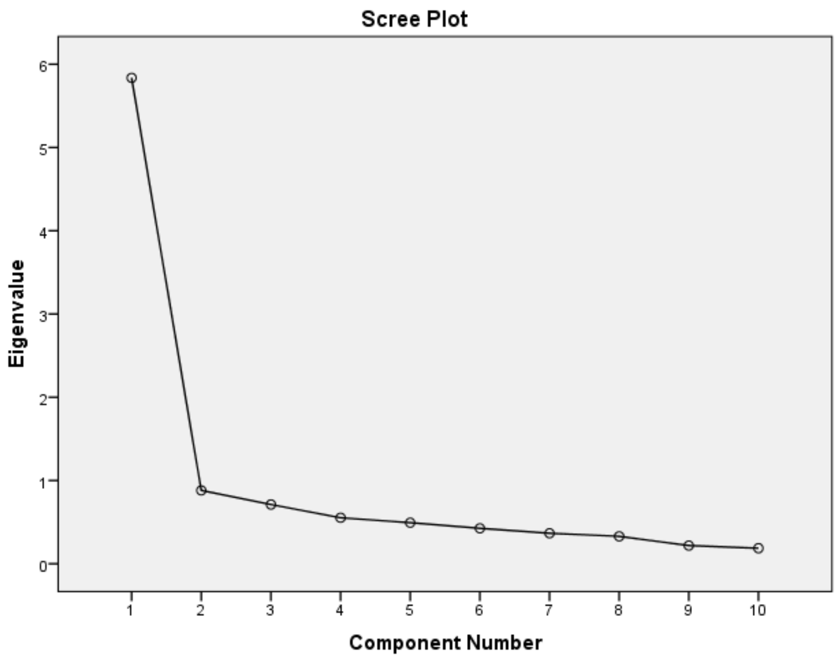
	Component
	1
Waiting time at specific points in processes.	.643
Patient/ Customer satisfaction	.733
Referral management	.782
Process mapping	.785
Fulfilment of targets and policies.	.690

a. 1 components extracted

Extraction Method: Principal Component Analysis.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.904
Bartlett's Test of Sphericity	Approx. Chi-Square	536.139
	df	45
	Sig.	.000



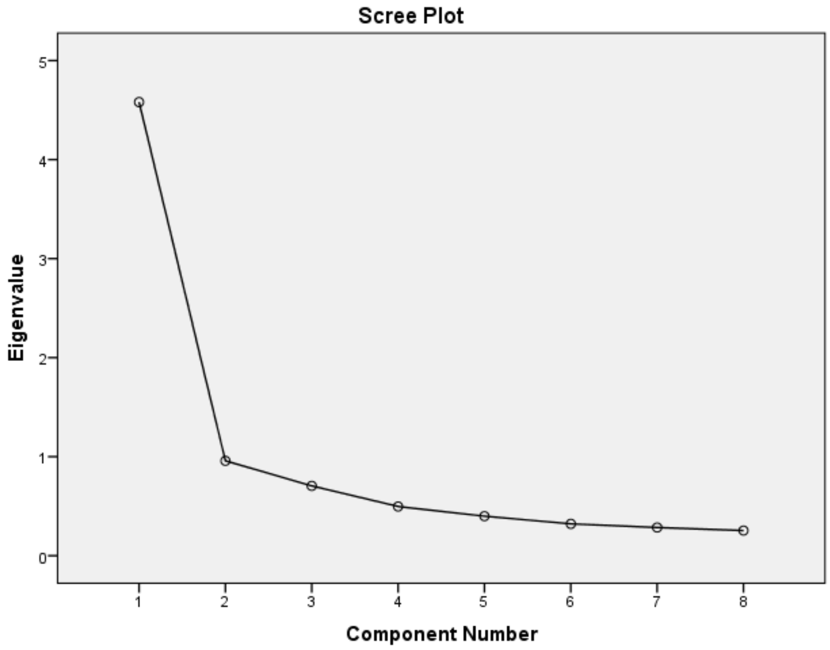
Component Matrix[a]

	Component
	1
Leadership	.809
Functions	.763
Value Streams	.841
Anchors a) People	.765
Anchors b) Processes	.811
Anchors c) Partners	.776
Anchors d) Promotions	.731
Anchors e) Problem Solving	.790
Lean Thinking	.784
Results	.522

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.880
Bartlett's Test of Sphericity	Approx. Chi-Square	371.711
	df	28
	Sig.	.000



Component Matrix[a]

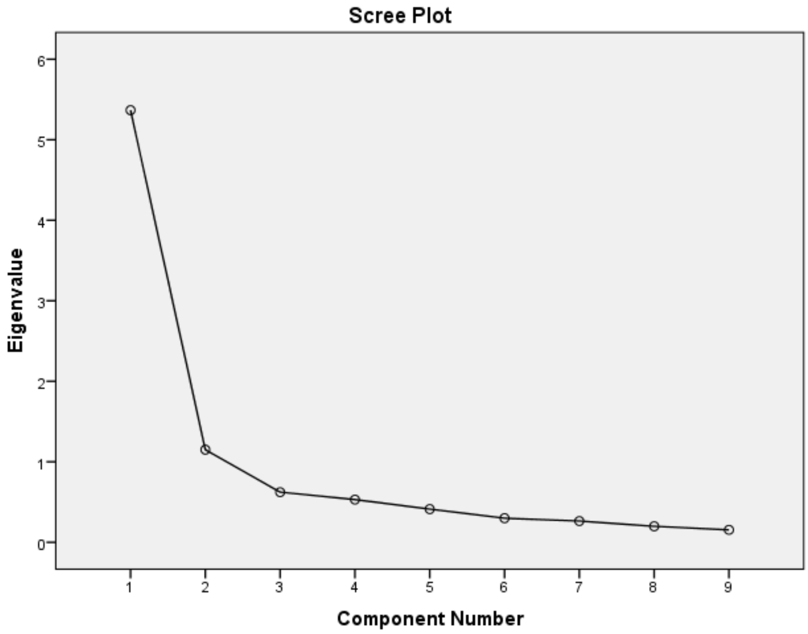
	Component
	1
Understanding demand and capacity	.641
Understanding value	.773
Having a process view	.838
Linking activity to the Strategy	.701
Strong committed leadership	.756
Communication strategy	.822
Training and development	.695
Steering group and project team	.805

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.857
Bartlett's Test of Sphericity	Approx. Chi-Square	539.876
	df	36
	Sig.	.000



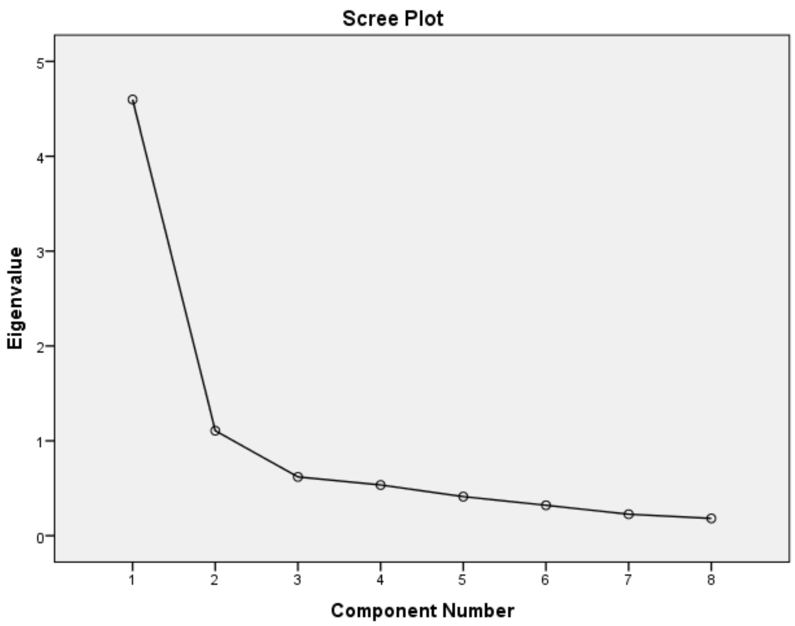
Rotated Component Matrix[a]

	Component	
	1	2
Leadership	.790	.239
Cultural Change	.750	.338
People Management	.783	.365
Partnerships	.846	.034
Processes	.553	.705
Product/Service Results	.704	.357
Policy Deployment	.734	.316
Waste Reduction	.223	.841
Root Cause Analysis	.193	.915

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 3 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.854
Bartlett's Test of Sphericity	Approx. Chi-Square	410.525
	df	28
	Sig.	.000



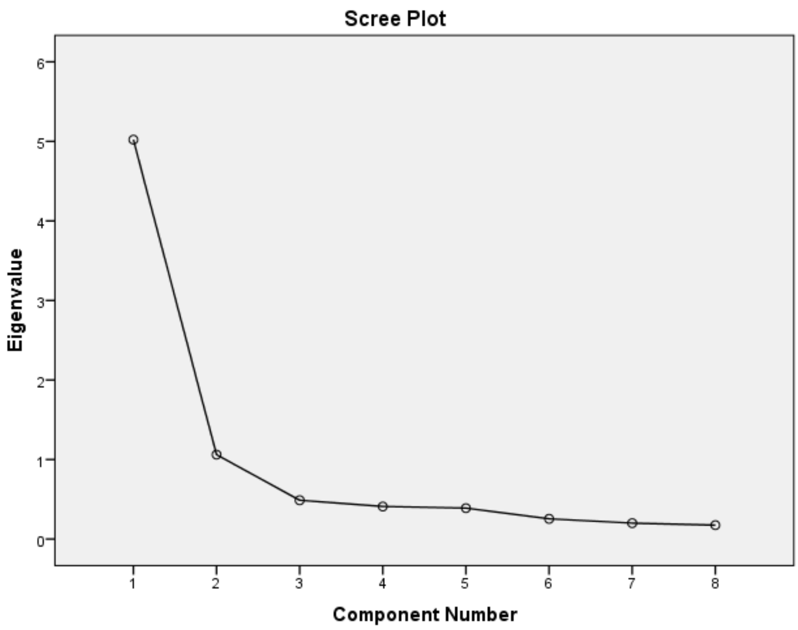
Rotated Component Matrix[a]

	Component	
	1	2
Top Management Commitment	.792	.157
Employee Engagement	.801	.373
Team Work	.814	.225
Training and Learning	.737	.346
Voice of Customer	.686	.239
Value Stream Mapping	.272	.820
Focus on Flow	.227	.899
Focus on Levelling	.325	.810

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 3 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.873
Bartlett's Test of Sphericity	Approx. Chi-Square	489.944
	df	28
	Sig.	.000



Rotated Component Matrix[a]

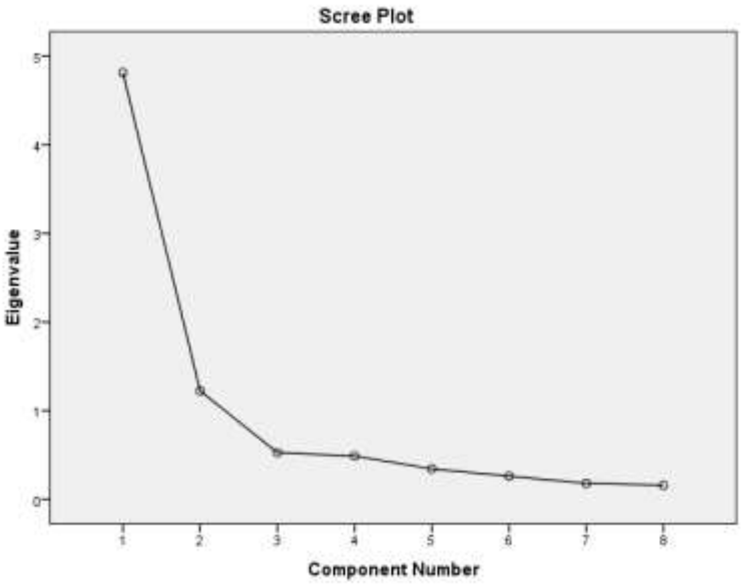
	Component	
	1	2
Process Improvement	.816	.300
Waste identification and elimination	.871	.129
Problem Solving	.797	.314
People and partner	.182	.913
Voice of Customer	.315	.833
Value Stream Mapping	.809	.184
Kaizen	.867	.237
Heijunka Scheduling	.730	.360

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 3 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.849
Bartlett's Test of Sphericity	Approx. Chi-Square	483.883
	df	28
	Sig.	.000



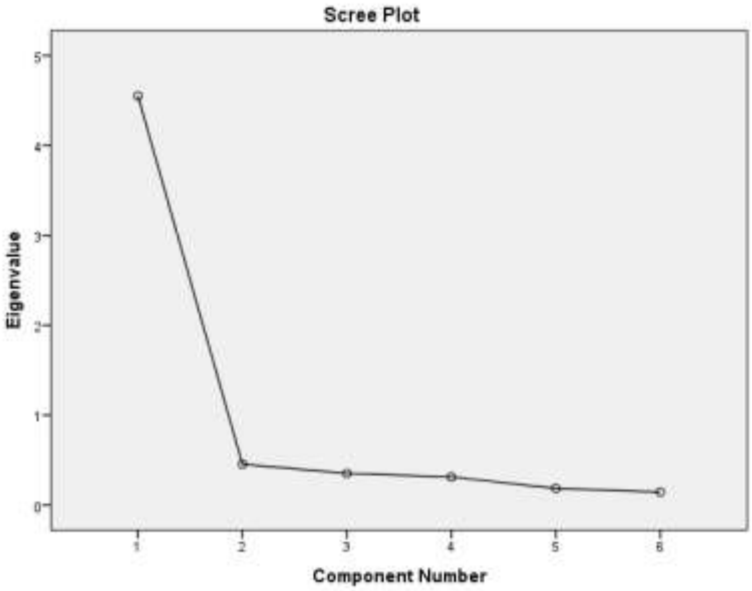
Rotated Component Matrix[a]

	Component	
	1	2
Top Management Commitment	.319	.731
Value for stakeholders.	.190	.844
Focus on value stream	.838	.241
Cultural and organisational development	.458	.736
Training	.175	.842
Value Stream Mapping	.830	.349
Kaizen (Continuous Improvement)	.847	.257
Lean assessment	.871	.223

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 3 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.885
Bartlett's Test of Sphericity	Approx. Chi-Square	449.844
	df	15
	Sig.	.000



Component Matrix[a]

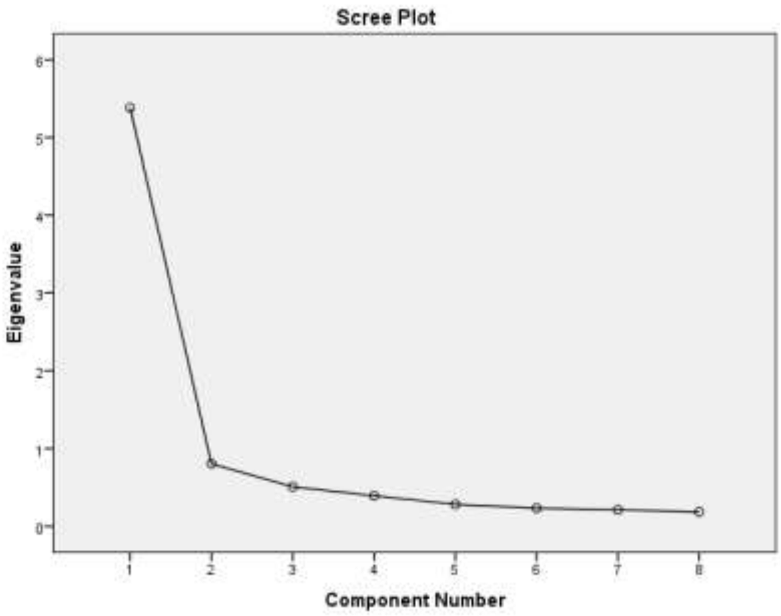
	Component
	1
Customer service requirements analysis	.860
Process description and modelling	.899
Value Stream Mapping	.854
Service performance measurement	.912
Optimisation & service performance improvement	.878
Continuous Improvement	.819

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.899
Bartlett's Test of Sphericity	Approx. Chi-Square	534.378
	df	28
	Sig.	.000



Component Matrix[a]

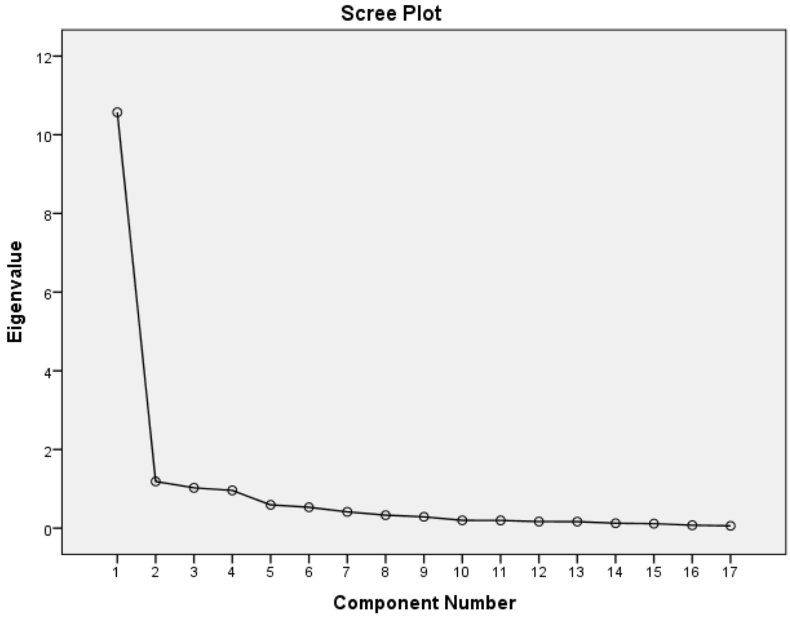
	Component
	1
Focus on Customer	.737
People	.807
Process	.878
Technology	.807
Shared Services	.745
Knowledge Management	.871
Continuous Optimization	.839
Efficiency Focus	.865

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.892
Bartlett's Test of Sphericity	Approx. Chi-Square	1553.686
	df	136
	Sig.	.000



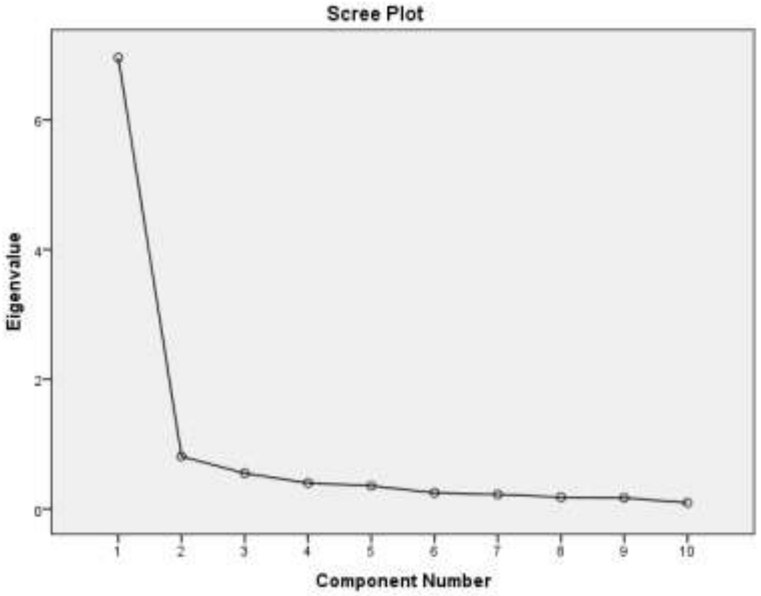
Rotated Component Matrix[a]

	Component		
	1	2	3
Transformational Leadership	.388	.559	.324
Willingness to change	.336	.525	.404
Emotional Competence	.274	.876	.126
Satisfaction with change	.252	.757	.357
Relational Competence	.268	.619	.506
Effective Communication	.491	.537	.483
Tools & Techniques Training	.198	.370	.782
Information Seamless Flow	.765	.232	.385
Material Seamless Flow	.799	.374	.269
People Seamless Flow	.773	.409	.215
Lean Sensei (Mentor / Teacher)	.663	.569	.134
Value Stream Achievements	.748	.177	.412
Trust Building	.437	.527	.465
Emotional Commitment	.386	.760	.205
Lean Values	.725	.391	.239
Technical Innovation	.281	.166	.860
Inter Organisation Achievement	.336	.221	.768

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 6 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.921
Bartlett's Test of Sphericity	Approx. Chi-Square	824.371
	df	45
	Sig.	.000



Component Matrix[a]

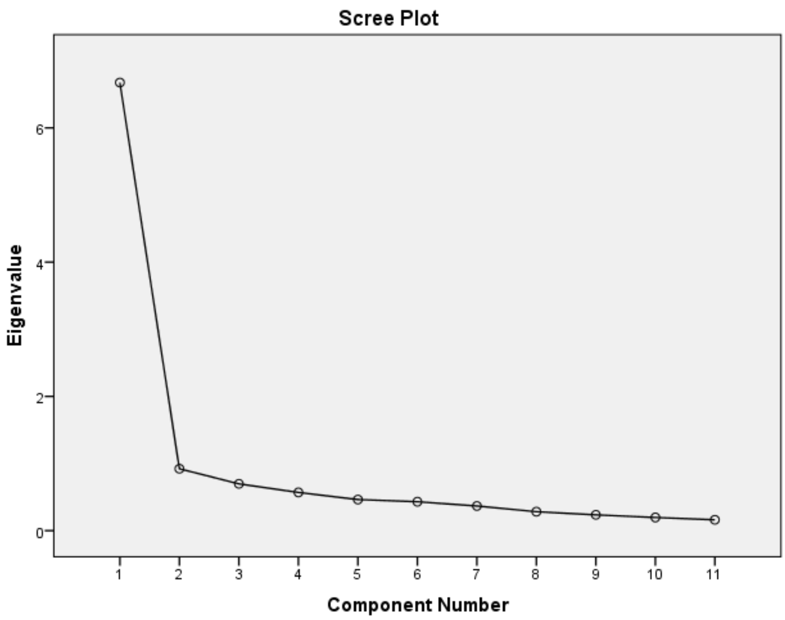
	Component
	1
Value Stream Mapping	.877
Standardize processes	.877
Continuous Improvement	.790
Senior Management Support	.788
Create Flow	.864
Waste identification and elimination	.851
Structured Knowledge Sharing	.836
Quality Circles	.837
Structured Problem Solving	.875
Heijunka Scheduling	.733

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.905
Bartlett's Test of Sphericity	Approx. Chi-Square	681.784
	df	55
	Sig.	.000



Component Matrix[a]

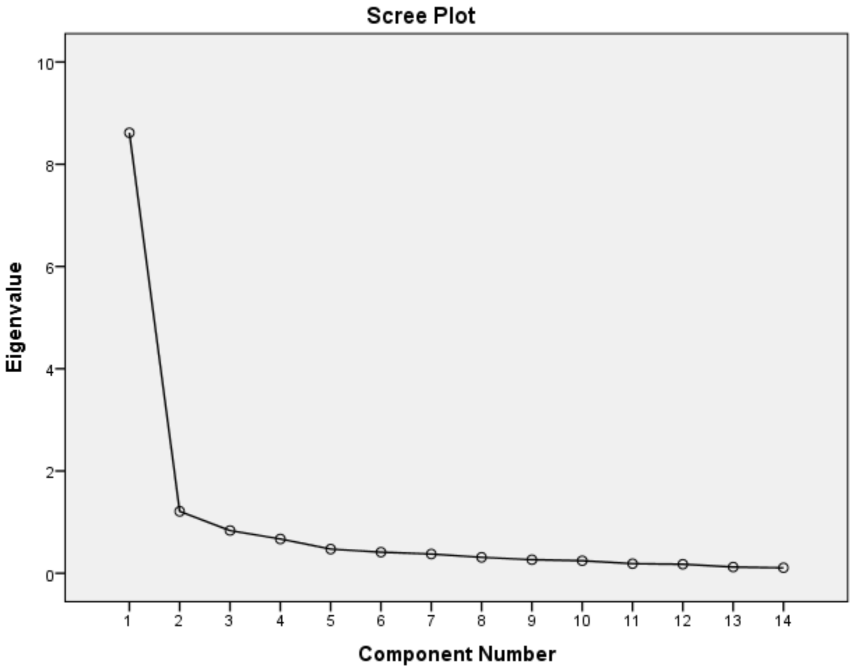
	Component
	1
Organization value and culture	.782
Knowledge management	.832
Technology management	.814
Capacity and availability management	.770
Causal analysis and resolution	.725
Continuous improvement	.708
Organizational training	.810
Supplier agreement and management	.793
Customer connection	.726
Value stream	.790
Visual control	.807

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.908
Bartlett's Test of Sphericity	Approx. Chi-Square	1071.114
	df	91
	Sig.	.000



Rotated Component Matrix[a]

	Component	
	1	2
Employee commitment & understanding	.272	.866
Employee training	.325	.781
Management commitment and understanding.	.311	.715
Infrastructural elements	.363	.652
Customer value	.458	.597
Identify waste.	.811	.300
Flow	.819	.329
Standardisation	.816	.339
Level and balance workloads	.760	.391
Zero Defects	.804	.275
Pull	.778	.345
Visualization	.716	.448
Multifunctional employees	.319	.768
Continuous improvement.	.713	.394

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 3 iterations.

Identifying Outliers Using Mahalanobis Distance

S. No	Mah_Dist	Proba_MH	Flag	S. No	Mah_Dist	Proba_MH	Flag
1	72.90278	0.00909	0	50	75.90614	0.00478	0
2	50.28665	0.34464	0	51	23.35005	0.99849	0
3	42.78241	0.64780	0	52	128.6658	0.00000	1
4	81.75893	0.00126	0	53	25.91882	0.99467	0
5	44.2745	0.58612	0	54	58.74747	0.11687	0
6	20.18186	0.99978	0	55	55.57384	0.18314	0
7	176.8478	0.00000	1	56	23.10571	0.99868	0
8	62.2367	0.06744	0	57	70.08734	0.01611	0
9	5.00377	1.00000	0	58	34.19469	0.91831	0
10	60.68302	0.08675	0	59	38.30326	0.81306	0
11	79.13477	0.00232	0	60	53.45549	0.24034	0
12	55.103	0.19491	0	61	35.56279	0.88904	0
13	29.26659	0.98017	0	62	49.85089	0.36062	0
14	32.08669	0.95244	0	63	51.04287	0.31777	0
15	28.9674	0.98213	0	64	57.26888	0.14232	0
16	31.94301	0.95431	0	65	52.99167	0.25410	0
17	62.2978	0.06676	0	66	37.85554	0.82700	0
18	30.50847	0.97016	0	67	42.43677	0.66181	0
19	46.76138	0.48237	0	68	63.07879	0.05856	0
20	71.88722	0.01121	0	69	41.25366	0.70856	0
21	52.86315	0.25803	0	70	17.91029	0.99996	0
22	27.00948	0.99151	0	71	50.00966	0.35476	0
23	67.33115	0.02741	0	72	59.50232	0.10427	0
24	52.98856	0.25419	0	73	64.75957	0.04378	0
25	64.77099	0.04369	0	74	51.12337	0.31497	0
26	15.98807	0.99999	0	75	31.54028	0.95927	0
27	38.39401	0.81017	0	76	40.77181	0.72693	0
28	61.68852	0.07380	0	77	28.35486	0.98568	0
29	19.0872	0.99990	0	78	55.76931	0.17840	0
30	19.0872	0.99990	0	79	61.85805	0.07280	0
31	50.75324	0.32792	0	80	13.76404	1.00000	0
32	58.42231	0.12265	0	81	47.38876	0.45669	0
33	42.78466	0.64771	0	82	46.17828	0.50651	0
34	34.47682	0.91275	0	83	22.46801	0.99908	0
35	27.66342	0.98898	0	84	25.90477	0.99470	0
36	173.5439	0.00000	1	85	38.78269	0.79752	0
37	18.77565	0.99992	0	86	79.60729	0.00191	0
38	37.24923	0.84495	0	87	10.85132	1.00000	0
39	37.24923	0.84495	0	88	56.80892	0.15469	0
40	50.01739	0.35447	0	89	60.42365	0.09038	0
41	80.99473	0.00151	0	90	67.31831	0.02748	0
42	73.73562	0.00763	0	91	38.22579	0.81552	0
43	43.09326	0.63509	0	92	6.3207	1.00000	0
44	31.69369	0.95743	0	93	51.30328	0.30878	0
45	77.06044	0.00371	0	94	17.50016	0.99997	0
46	70.64775	0.01441	0	95	57.95481	0.13136	0
47	7.00706	1.00000	0	96	41.35385	0.70468	0
48	57.13112	0.14784	0	97	38.53367	0.80567	0
49	58.76849	0.11650	0	98	34.5585	0.91109	0

S. No	Mah_Dist	Proba_MH	Flag
99	33.49963	0.93099	0
100	32.78133	0.94260	0
101	14.68454	1.00000	0
102	47.80531	0.43986	0
103	75.37289	0.00321	0
104	60.9617	0.08299	0
105	37.5738	0.83548	0
106	6.3207	1.00000	0
107	122.5621	0.00000	1
108	29.09398	0.98132	0
109	55.34705	0.18874	0
110	9.74664	1.00000	0
111	37.95552	0.82394	0
112	44.21062	0.58879	0
113	7.9017	1.00000	0
114	69.33219	0.01869	0
115	46.23425	0.50418	0
116	34.98396	0.90213	0
117	30.71549	0.96818	0
118	31.93261	0.95444	0
119	13.18387	1.00000	0
120	45.08812	0.55206	0
121	63.75292	0.05219	0
122	60.56683	0.08836	0
123	45.56103	0.53226	0
124	65.43297	0.03883	0
125	46.20859	0.50525	0
126	50.30999	0.34379	0
127	5.19266	1.00000	0
128	66.41757	0.03248	0
129	21.37057	0.99953	0
130	77.47321	0.00338	0
131	32.65827	0.94444	0
132	51.98299	0.28601	0
133	42.31384	0.66676	0
134	116.533	0.00000	1
135	7.00706	1.00000	0
136	21.40609	0.99952	0
137	53.69068	0.23335	0
138	26.93132	0.99178	0
139	68.3541	0.02259	0
140	37.25613	0.84476	0
141	32.2592	0.95012	0
142	47.54925	0.45018	0
143	51.80427	0.29190	0
144	18.76569	0.99992	0
145	27.00948	0.99151	0
146	42.59069	0.65559	0
147	66.79399	0.03026	0
148	54.51799	0.21026	0
149	33.05669	0.93832	0

S. No	Mah_Dist	Proba_MH	Flag
150	45.87618	0.51909	0
151	38.36523	0.81109	0
152	64.3661	0.04692	0
153	132.2046	0.00000	1
154	60.25646	0.09278	0
155	55.17222	0.19315	0
156	50.35737	0.34208	0
157	49.89632	0.35894	0
158	32.68767	0.94400	0
159	54.63667	0.20708	0
160	58.58501	0.11973	0
161	32.79954	0.94232	0
162	49.38246	0.37819	0
163	56.12088	0.17010	0
164	101.88818	0.00001	1
165	18.56098	0.99994	0
166	60.37901	0.09101	0
167	44.2745	0.58612	0
168	21.86713	0.99936	0
169	5.00377	1.00000	0
170	60.68302	0.08675	0
171	56.65403	0.15806	0
172	23.13474	0.99866	0
173	32.08669	0.95244	0
174	26.23298	0.99388	0
175	30.50847	0.97016	0
176	78.87889	0.00246	0
177	26.45135	0.99328	0
178	46.34446	0.49961	0
179	60.01399	0.09636	0
180	50.75324	0.32792	0
181	62.6923	0.06251	0
182	42.78466	0.64771	0
183	34.47682	0.91275	0
184	16.71914	0.99999	0
185	31.69369	0.95743	0
186	6.3207	1.00000	0
187	63.08245	0.05853	0
188	33.49963	0.93099	0
189	25.91882	0.99467	0
190	69.48893	0.01813	0
191	23.10571	0.99868	0
192	75.34707	0.00540	0
193	38.9468	0.79206	0
194	51.04287	0.31777	0
195	52.99167	0.25410	0
196	39.99302	0.75566	0
197	42.43677	0.66181	0
198	64.05194	0.04956	0
199	41.25366	0.70856	0
200	111.37593	0.00000	1

S. No	Mah_Dist	Proba_MH	Flag
201	44.61923	0.57170	0
202	22.09993	0.99926	0
203	123.69879	0.00000	1
204	6.3207	1.00000	0
205	12.52734	1.00000	0
206	18.06763	0.99996	0
207	6.3207	1.00000	0
208	17.50016	0.99997	0
209	41.35385	0.70468	0
210	45.87618	0.51909	0
211	47.80531	0.43986	0
212	37.5738	0.83548	0
213	6.3207	1.00000	0
214	37.95552	0.82394	0
215	69.33219	0.01869	0
216	46.23425	0.50418	0
217	45.56103	0.53226	0
218	21.37057	0.99953	0
219	77.47321	0.00338	0
220	32.65827	0.94444	0
221	68.3541	0.02259	0
222	32.2592	0.95012	0
223	18.76569	0.99992	0
224	42.59069	0.65559	0
225	54.51799	0.21026	0
226	22.09993	0.99926	0
227	38.36523	0.81109	0
228	60.25646	0.09278	0
229	49.59531	0.37016	0
230	32.68767	0.94400	0
231	58.58501	0.11973	0
232	32.79954	0.94232	0
233	49.38246	0.37819	0
234	18.56098	0.99994	0
235	60.37901	0.09101	0
236	38.53367	0.80567	0
237	31.93261	0.95444	0
238	58.09146	0.12877	0
239	57.95481	0.13136	0
240	27.00948	0.99151	0
241	45.56103	0.53226	0
242	33.06167	0.93824	0
243	42.59069	0.65559	0
244	32.2592	0.95012	0
245	42.43677	0.66181	0
246	31.69369	0.95743	0
247	42.8577	0.64473	0
248	18.56098	0.99994	0
249	32.65827	0.94444	0
250	70.93894	0.01359	0
251	65.30517	0.03973	0

S. No	Mah_Dist	Proba_MH	Flag
252	60.27046	0.09258	0
253	33.06167	0.93824	0
254	34.47682	0.91275	0
255	47.80531	0.43986	0
256	142.14058	0.00000	1
257	63.8098	0.05168	0
258	60.25646	0.09278	0
259	31.69369	0.95743	0
260	18.06763	0.99996	0
261	37.67442	0.83248	0
262	114.2816	0.00000	1
263	18.76569	0.99992	0
264	51.94292	0.28732	0
265	60.37901	0.09101	0
266	46.34446	0.49961	0
267	34.47682	0.91275	0
268	51.04287	0.31777	0
269	65.15603	0.04081	0
270	25.91882	0.99467	0
271	30.71549	0.96818	0
272	9.74664	1.00000	0
273	70.92701	0.01363	0
274	30.50847	0.97016	0
275	46.17828	0.50651	0
276	67.31831	0.02748	0
277	42.43677	0.66181	0
278	21.1966	0.99958	0
279	28.35486	0.98568	0
280	50.35737	0.34208	0
281	34.98396	0.90213	0
282	32.2592	0.95012	0
283	46.20859	0.50525	0
284	6.3207	1.00000	0
285	27.00948	0.99151	0
286	45.56103	0.53226	0
287	33.06167	0.93824	0
288	63.82246	0.05157	0
289	32.2592	0.95012	0
290	42.43677	0.66181	0
291	31.69369	0.95743	0
292	42.8577	0.64473	0
293	18.56098	0.99994	0
294	32.65827	0.94444	0
295	65.5352	0.03813	0
296	62.2367	0.06744	0
297	62.1131	0.06883	0
298	153.57476	0.00000	1

DATA ANALYSIS OF THE PROPOSED FRAMEWORK
Descriptive Statistics

Top Management Commitment (TMC)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Acts as change leader	4.24	.922	-.930	-.115	1	12	53	71	149
Vision & mission echo the principles of lean thinking leader	3.94	.996	-.624	-.481	2	27	58	99	100
Inclination on quality rather than cost	3.63	1.057	-.264	-.722	6	34	93	79	74
Resources and time allocation for Lean.	3.74	1.027	-.598	-.305	6	34	59	116	71
Understanding of Lean activities and practices	3.65	1.065	-.407	-.537	8	33	82	91	72

Customer Relationship Management (CRM)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Voice of Customer	4.05	.922	-.550	-.723	0	17	64	94	111
Customers' periodic surveys /feedbacks etc.	4.04	.892	-.584	-.361	1	13	63	106	103
Extensive customer service program.	3.98	.814	-.348	-.362	1	6	74	123	82
Comprehensive database of customers.	4.18	.880	-1.111	1.310	4	8	41	112	121

Human Resource and Change Management (HRCM)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Willingness and motivation for change.	3.63	.978	-.174	-.679	3	31	98	91	63
Organisation culture is supportive of lean.	3.77	1.004	-.501	-.277	6	23	80	100	77
Employees as partners.	3.78	.958	-.454	-.076	6	14	92	100	74
Trainings in lean tools, problem identification etc.	3.78	1.024	-.464	-.573	4	30	73	96	83
Trainings in interactive / social skills.	3.86	.874	-.493	-.208	1	20	65	131	69
Multi skilled employees and cross functional teams.	3.79	1.002	-.468	-.474	4	27	75	100	80
Employees empowerment	3.30	1.080	-.243	-.502	17	45	98	86	40

Elimination of Waste (EOW)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Current/future state analysis using VSM.	3.81	.922	-.473	-.070	4	16	82	113	71
Visualisation of process maps and updating them.	3.77	.975	-.416	-.213	6	15	95	93	77
Eliminating/reducing wastes	3.88	.888	-.212	-.910	15	87	102	82	15
Producing defect free services.	3.76	.957	-.437	-.187	5	19	87	105	70
Quality of Input	3.76	.985	-.522	-.061	7	18	85	103	73

Continuous Process Improvement (CPI)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Periodic meetings to discuss continuous improvement.	3.98	.872	-.221	-1.116	0	8	87	93	98
Processes have continuous flow	3.93	.917	-.390	-.682	1	15	79	98	93
Clearly defined and standardised processes.	3.94	.852	-.222	-.901	0	10	83	108	85
Measuring all key process metrics	4.00	.950	-.538	-.744	0	22	63	95	106
Structured, well defined action plan for problem solving and process improvement.	3.87	.966	-.489	-.225	5	12	88	91	90
Using continuous improvement tools	3.94	.912	-.448	-.692	0	20	67	108	91

Supplier Management (SPM)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Suppliers as partners.	3.42	1.053	-.259	-.314	14	31	111	80	50
Training programmes for suppliers.	3.32	1.099	-.154	-.520	17	41	110	69	49
Supplier selection based on value addition and not only on cost.	3.47	1.094	-.267	-.496	14	33	104	75	60
Extensive supplier management programme.	3.52	1.075	-.285	-.460	12	30	104	77	63

Information Technology and Knowledge Management (ITKM)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Locating and sharing information as needed	3.86	.922	-.475	-.335	2	20	72	114	78
Managing accuracy, timeliness, relevance, quantity and form of information.	3.93	.835	-.414	-.057	2	7	77	123	77
Using reliable & thoroughly tested technology.	3.86	.837	-.208	-.698	12	13	83	120	70
Enhancing technological capability.	3.92	.838	-.430	-.211	1	12	70	128	75
Enhancing the knowledge base for lean.	3.81	.986	-.483	-.394	4	23	77	100	82
Developing new/innovative services and practices.	3.93	.864	-.391	-.431	1	12	75	116	82
Transforming tacit knowledge into explicit organisational knowledge	3.81	.917	-.468	-.171	3	19	77	117	70
Capturing , reviewing, standardising and sharing learning , best practices etc.	3.88	.850	-.115	-.953	0	10	92	106	78

Servicescapes (SS)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Comfortable, clean physical environment and ambient conditions.	4.11	.748	-.533	.026	0	7	45	144	90
Equipments, physical facilities, signboards etc. to educate and influence customers.	3.92	.863	-.477	-.399	0	19	61	129	77
Physical layout, facilities etc. support uninterrupted flow.	4.03	.803	-.309	-.780	0	6	69	120	91
Employees with pleasing and neat appearance for quality assurance.	4.02	.781	-.304	-.635	0	19	66	130	84

Operational Performance (OP)

Items	Mean	S.D.	Skewness	Kurtosis	1	2	3	4	5
Waste Reduction	3.81	.813	-.107	-.668	0	12	91	123	60
Cost Reduction	3.80	.858	-.209	-.669	0	18	85	119	64
Resource Utilisation	3.84	.835	-.237	-.420	1	11	87	121	66
Quality	4.01	.772	-.484	.166	1	6	59	142	78
Delivery	3.95	.859	-.468	-.121	2	9	74	118	83
Flexibility	3.74	.935	-.154	-.694	2	19	103	90	72
Customer Satisfaction	3.94	.770	-.089	-.872	0	4	81	128	73
Innovation	3.72	.925	-.130	-.654	2	19	105	92	68

Descriptive Statistics (Change in Annual Sales Turnover)

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	0	0	0	0
2	0	0	0	0
3	56	19.6	19.6	19.6
4	147	51.4	51.4	71.0
5	83	29.0	29.0	100.0
Total	286	100.0	100.0	

Descriptive Statistics (Trend Market Share)

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	0	0	0	0
2	0	0	0	0
3	77	26.9	26.9	26.9
4	153	53.5	53.5	80.4
5	56	19.6	19.6	100.0
Total	286	100.0	100.0	

Descriptive Statistics (Trend Profits)

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	0	0	0	0
2	0	0	0	0
3	65	22.7	22.7	22.7
4	140	49	49	71.7
5	81	28.3	28.3	100.0
Total	286	100.0	100.0	

Descriptive Statistics (Trend Customer Base)

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	0	0	0	0
2	0	0	0	0
3	82	28.7	28.7	28.7
4	130	45.5	45.5	74.2
5	74	25.8	25.8	100.0
Total	286	100.0	100.0	

Reliability Statistics

Scale: Top Management Commitment

Reliability Statistics

Cronbach's	Cronbach's Alpha Based on Standardized	N of Items
.884	.885	5

Inter-Item Correlation Matrix

	Acts as change leader	Vision & mission echo the principles of lean thinking	Inclination on quality rather than cost	Resources and time allocation for Lean.	Understanding of Lean activities and practices
Acts as change leader	1.000	.731	.512	.529	.594
Vision & mission echo the principles of lean thinking.	.731	1.000	.538	.512	.667
Inclination on quality rather than cost.	.512	.538	1.000	.642	.634
Resources and time allocation for Lean.	.529	.512	.642	1.000	.696
Understanding of Lean activities and practices	.594	.667	.634	.696	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.841	3.633	4.241	.608	1.167	.065	5
Inter-Item Correlations	.606	.512	.731	.219	1.428	.006	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Acts as change leader	14.96	12.241	.699	.572	.865
Vision & mission echo the principles of lean thinking.	15.27	11.669	.726	.623	.858
Inclination on quality rather than cost.	15.57	11.530	.690	.500	.867
Resources and time allocation for Lean.	15.46	11.576	.711	.562	.862
Understanding of Lean activities and practices	15.55	10.936	.786	.636	.844

Scale: Human Resource and Change Management (HRCM)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.904	.905	7

Inter-Item Correlation Matrix

	Willingness and motivation for change.	Organisation culture is supportive of	Employees as partners.	Trainings in lean tools, problem	Trainings in interactive / social skills.	Multi skilled employees & cross functional teams.	Employees empowerment
Willingness and motivation for change.	1.000	.585	.637	.529	.458	.564	.502
Organisation culture is supportive of lean.	.585	1.000	.781	.619	.552	.507	.570
Employees as partners.	.637	.781	1.000	.616	.575	.575	.507
Trainings in lean tools, problem identification etc.	.529	.619	.616	1.000	.747	.526	.647
Trainings in interactive / social skills.	.458	.552	.575	.747	1.000	.504	.524
Multi skilled employees & cross functional teams.	.564	.507	.575	.526	.504	1.000	.556
Employees empowerment	.502	.570	.507	.647	.524	.556	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.709	3.304	3.864	.559	1.169	.037	7
Inter-Item Correlations	.575	.458	.781	.324	1.707	.006	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Willingness and motivation for change.	22.33	22.861	.675	.490	.894
Organisation culture is supportive of lean.	22.14	22.306	.754	.663	.885
Employees as partners.	22.19	22.243	.771	.692	.883
Trainings in lean tools, problem identification etc.	22.18	21.740	.769	.676	.883
Trainings in interactive / social skills.	22.10	23.478	.695	.587	.892
Multi skilled employees and cross functional teams.	22.17	22.769	.665	.470	.895
Employees empowerment	22.66	22.037	.683	.515	.894

Scale: Customer Relationship Management (CRM)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.877	.877	4

Inter-Item Correlation Matrix

	Voice of Customer	Customers' periodic surveys /feedbacks etc.	Extensive customer service program.	Comprehensive database of customers.
Voice of Customer	1.000	.745	.717	.574
Customers' periodic surveys /feedbacks etc.	.745	1.000	.736	.582
Extensive customer service program.	.717	.736	1.000	.496
Comprehensive database of customers.	.574	.582	.496	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.060	3.976	4.182	.206	1.052	.008	4
Inter-Item Correlations	.641	.496	.745	.248	1.500	.010	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Voice of Customer	12.20	4.923	.790	.637	.820
Customers' periodic surveys /feedbacks etc.	12.20	5.004	.804	.660	.815
Extensive customer service program.	12.27	5.487	.749	.606	.839
Comprehensive database of customers.	12.06	5.677	.609	.383	.890

Scale: Elimination of Waste

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.875	.877	5

Inter-Item Correlation Matrix

	Current/future state analysis using VSM.	Visualisation of process maps and updating	Eliminating/reducing wastes	Producing defect free services.	Quality of input
Current/future state analysis using VSM.	1.000	.766	.768	.475	.486
Visualisation of process maps and updating them.	.766	1.000	.689	.485	.501
Eliminating/reducing wastes	.768	.689	1.000	.580	.556
Producing defect free	.475	.485	.580	1.000	.567
Quality of input	.486	.501	.556	.567	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.794	3.755	3.878	.122	1.033	.003	5
Inter-Item Correlations	.587	.475	.768	.293	1.616	.012	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Current/future state analysis using VSM.	15.16	9.707	.758	.697	.836
Visualisation of process maps and updating them.	15.20	9.529	.737	.625	.840
Eliminating/reducing wastes	15.09	9.718	.796	.671	.828
Producing defect free services.	15.21	10.203	.621	.427	.868
Quality of input	15.21	10.061	.622	.414	.869

Scale: Continuous Process Improvement (CPI)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.929	.929	6

Inter-Item Correlation Matrix

	Periodic meetings to discuss continuous improvement.	Processes have continuous flow	Clearly defined and standardised processes.	Measuring all key process metrics	Struct., well def. action plan for problem solving & process improvement.	Using continuous improvement tools
Periodic meetings to discuss continuous improvement.	1.000	.744	.645	.652	.651	.643
Processes have continuous	.744	1.000	.673	.669	.612	.650
Clearly defined and standardised processes.	.645	.673	1.000	.741	.791	.677
Measuring all key process metrics	.652	.669	.741	1.000	.718	.705
Struct., well def. action plan for problem solving & process improvement.	.651	.612	.791	.718	1.000	.716
Using continuous improvement tools	.643	.650	.677	.705	.716	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.944	3.871	3.997	.126	1.033	.002	6
Inter-Item Correlations	.686	.612	.791	.179	1.293	.002	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's α if Item Deleted
Periodic meetings to discuss continuous improvement.	19.68	15.979	.767	.628	.919
Processes have continuous flow	19.73	15.671	.768	.642	.919
Clearly defined and standardised processes.	19.73	15.799	.822	.711	.912
Measuring all key process metrics	19.67	15.205	.808	.661	.913
Struct., well def. action plan for problem solving & process improvement.	19.79	15.091	.808	.705	.914
Using continuous improvement tools	19.72	15.613	.783	.622	.917

Scale: Supplier Management (SPM)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.933	.933	4

Inter-Item Correlation Matrix

	Suppliers as partners.	Training programmes for suppliers.	Supplier selection based on value addition and not only on cost.	Extensive supplier management programme.
Suppliers as partners.	1.000	.822	.705	.784
Training programmes for suppliers.	.822	1.000	.691	.781
Supplier selection based on value addition and not only on cost.	.705	.691	1.000	.884
Extensive supplier management programme.	.784	.781	.884	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	No. of Items
Item Means	3.434	3.322	3.521	.199	1.060	.007	4
Inter-Item Correlations	.778	.691	.884	.192	1.279	.005	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Suppliers as partners.	10.31	9.148	.832	.728	.916
Training programmes for suppliers.	10.41	8.938	.823	.724	.919
Supplier selection based on value addition and not only on cost.	10.27	8.996	.817	.781	.921
Extensive supplier management programme.	10.21	8.702	.899	.846	.894

Scale: Information Technology and Knowledge Management

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.934	.934	8

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.877	3.811	3.930	.119	1.031	.002	8
Inter-Item Correlations	.638	.530	.807	.276	1.521	.005	8

Inter-Item Correlation Matrix

	Locating & sharing information as needed	Managing accuracy, timeliness etc. of info.	Use of reliable & tested technology	Enhancing technological capability.	Enhancing the know. base for lean	Developing new/innovative services & practices.	Transf. tacit know. into explicit knowledge	Capt. , review, sharing etc best
Locating and sharing information as needed	1.000	.657	.643	.717	.643	.591	.645	.610
Managing accuracy, timeliness etc. of info.	.657	1.000	.654	.604	.581	.582	.601	.601
Use of reliable & tested technology	.643	.654	1.000	.710	.552	.613	.533	.608
Enhancing tech.	.717	.604	.710	1.000	.573	.530	.597	.563
Enhancing the know. base for lean	.643	.581	.552	.573	1.000	.767	.807	.656
Developing new/innovative services	.591	.582	.613	.530	.767	1.000	.749	.768
Transf. tacit know. into explicit knowledge	.645	.601	.533	.597	.807	.749	1.000	.705
Capt. , review, sharing best practices etc	.610	.601	.608	.563	.656	.768	.705	1.000

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Locating and sharing information as needed	27.15	25.906	.775	.642	.924
Managing accuracy, timeliness etc. of info.	27.08	26.989	.731	.562	.927
Use of reliable & tested technology	27.15	26.942	.735	.634	.927
Enhancing tech. capability.	27.09	26.939	.734	.638	.927
Enhancing the know. base for lean	27.20	25.206	.793	.725	.923
Developing new/innovative services & practices.	27.08	26.225	.798	.734	.923
Transf. tacit know. into explicit knowledge	27.20	25.692	.806	.733	.922
Capt. , review, sharing best practices etc	27.13	26.502	.777	.660	.924

Scale: Servicescape (SS)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.909	.910	4

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	No. of Items
Item Means	4.022	3.923	4.108	.185	1.047	.006	4
Inter-Item Correlations	.717	.632	.800	.167	1.265	.004	4

Inter-Item Correlation Matrix

	Comfortable, clean physical environment & ambient conditions.	Equip., physical fac., signboards etc. to educate & influence customers.	Physical layout, facilities etc. support uninterrupted flow.	Employees with pleasing & neat appearance for quality assurance.
Comfortable, clean physical environment and ambient conditions.	1.000	.735	.800	.662
Equip., physical fac., signboards etc. to educate & influence customers.	.735	1.000	.784	.632
Physical layout, facilities etc. support uninterrupted flow.	.800	.784	1.000	.687
Employees with pleasing and neat appearance for quality assurance.	.662	.632	.687	1.000

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Comfortable, clean physical environment and ambient conditions.	11.98	4.800	.819	.685	.875
Equip., physical fac., signboards etc. to educate & influence customers.	12.16	4.411	.797	.654	.883
Physical layout, facilities etc. support uninterrupted flow.	12.05	4.492	.855	.741	.860
Employees with pleasing and neat appearance for quality assurance.	12.07	4.946	.716	.518	.909

Scale: Operational Performance

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.939	.940	8

Inter-Item Correlation Matrix

	Wastes Reduction	Costs Reduction	Resource Utilisation	Quality	Delivery	Flexibility	Customer Satisfaction	Innovation
Wastes Reduction	1.000	.740	.750	.697	.669	.598	.661	.585
Costs Reduction	.740	1.000	.734	.666	.691	.626	.589	.539
Resource Utilisation	.750	.734	1.000	.738	.727	.669	.657	.672
Quality	.697	.666	.738	1.000	.726	.617	.680	.580
Delivery	.669	.691	.727	.726	1.000	.734	.754	.560
Flexibility	.598	.626	.669	.617	.734	1.000	.671	.664
Customer Satisfaction	.661	.589	.657	.680	.754	.671	1.000	.568
Innovation	.585	.539	.672	.580	.560	.664	.568	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	No. of Items
Item Means	3.851	3.717	4.014	.297	1.080	.011	8
Inter-Item Correlations	.663	.539	.754	.215	1.400	.004	8

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Wastes Reduction	27.00	25.088	.795	.679	.930
Costs Reduction	27.01	24.870	.774	.655	.931
Resource Utilisation	26.97	24.536	.846	.734	.926
Quality	26.79	25.427	.796	.657	.930
Delivery	26.86	24.465	.827	.733	.928
Flexibility	27.07	24.206	.776	.650	.932
Customer Satisfaction	26.86	25.599	.774	.646	.932
Innovation	27.09	24.918	.698	.550	.937

Lean Elements Bivariate Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	1																				
2	.731**	1																			
3	.512**	.538**	1																		
4	.529**	.512**	.642**	1																	
5	.594**	.667**	.634**	.696**	1																
6	.352**	.376**	.377**	.407**	.495**	1															
7	.514**	.607**	.508**	.567**	.643**	.585**	1														
8	.435**	.537**	.459**	.597**	.580**	.637**	.781**	1													
9	.386**	.558**	.416**	.524**	.529**	.529**	.619**	.616**	1												
10	.307**	.401**	.265**	.402**	.382**	.458**	.552**	.575**	.747**	1											
11	.409**	.475**	.386**	.434**	.420**	.564**	.507**	.575**	.526**	.504**	1										
12	.335**	.465**	.442**	.372**	.483**	.502**	.570**	.507**	.647**	.524**	.556**	1									
13	.433**	.381**	.445**	.457**	.388**	.431**	.489**	.559**	.464**	.478**	.500**	.465**	1								
14	.258**	.192**	.328**	.356**	.225**	.334**	.391**	.450**	.382**	.426**	.323**	.301**	.745**	1							
15	.316**	.370**	.369**	.315**	.265**	.332**	.333**	.416**	.373**	.439**	.407**	.408**	.717**	.736**	1						
16	.361**	.305**	.314**	.371**	.297**	.258**	.381**	.431**	.406**	.448**	.363**	.363**	.574**	.582**	.496**	1					
17	.282**	.380**	.266**	.303**	.349**	.380**	.358**	.471**	.498**	.468**	.521**	.475**	.534**	.372**	.428**	.229**	1				
18	.261**	.364**	.244**	.280**	.280**	.366**	.328**	.410**	.470**	.412**	.496**	.487**	.523**	.398**	.404**	.344**	.766**	1			
19	.400**	.471**	.288**	.342**	.433**	.465**	.411**	.553**	.476**	.449**	.594**	.485**	.530**	.352**	.379**	.231**	.768**	.689**	1		
20	.294**	.363**	.345**	.399**	.370**	.330**	.270**	.392**	.390**	.262**	.399**	.313**	.470**	.377**	.353**	.274**	.475**	.485**	.580**	1	
21	.339**	.414**	.339**	.365**	.465**	.293**	.300**	.393**	.348**	.284**	.382**	.310**	.414**	.378**	.378**	.294**	.486**	.501**	.556**	.567**	1
22	.446**	.423**	.389**	.570**	.469**	.395**	.412**	.507**	.499**	.434**	.478**	.460**	.533**	.470**	.370**	.338**	.545**	.462**	.559**	.508**	.477**
23	.409**	.483**	.337**	.455**	.393**	.328**	.449**	.494**	.463**	.422**	.431**	.431**	.476**	.415**	.317**	.385**	.537**	.524**	.585**	.541**	.542**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
24	.403**	.372**	.317**	.414**	.316**	.334**	.403**	.473**	.391**	.347**	.375**	.402**	.548**	.470**	.392**	.465**	.503**	.473**	.514**	.429**	.488**
25	.434**	.423**	.317**	.373**	.367**	.331**	.339**	.365**	.382**	.312**	.287**	.388**	.565**	.531**	.431**	.446**	.492**	.473**	.507**	.509**	.596**
26	.291**	.239**	.290**	.408**	.287**	.279**	.316**	.431**	.348**	.349**	.308**	.344**	.593**	.604**	.402**	.523**	.456**	.464**	.431**	.474**	.476**
27	.312**	.336**	.252**	.456**	.388**	.346**	.354**	.463**	.472**	.453**	.386**	.413**	.591**	.482**	.395**	.437**	.584**	.573**	.607**	.527**	.575**
28	.292**	.353**	.402**	.420**	.446**	.391**	.393**	.446**	.395**	.364**	.422**	.442**	.363**	.315**	.278**	.299**	.500**	.502**	.487**	.438**	.454**
29	.294**	.317**	.404**	.450**	.492**	.349**	.398**	.452**	.455**	.367**	.378**	.461**	.321**	.335**	.268**	.273**	.463**	.489**	.425**	.355**	.480**
30	.308**	.401**	.365**	.414**	.527**	.497**	.446**	.479**	.476**	.379**	.472**	.550**	.330**	.273**	.230**	.279**	.465**	.431**	.529**	.448**	.395**
31	.329**	.407**	.367**	.418**	.531**	.458**	.442**	.478**	.524**	.382**	.449**	.537**	.312**	.261**	.219**	.296**	.477**	.480**	.519**	.425**	.404**
32	.473**	.521**	.455**	.447**	.479**	.308**	.381**	.409**	.384**	.355**	.492**	.473**	.511**	.331**	.472**	.442**	.397**	.397**	.429**	.422**	.392**
33	.378**	.412**	.297**	.425**	.383**	.351**	.441**	.511**	.405**	.415**	.511**	.378**	.546**	.451**	.457**	.347**	.497**	.515**	.519**	.479**	.406**
34	.420**	.419**	.320**	.334**	.368**	.341**	.437**	.447**	.338**	.353**	.442**	.395**	.490**	.369**	.407**	.434**	.402**	.447**	.459**	.344**	.292**
35	.405**	.423**	.285**	.384**	.418**	.269**	.299**	.380**	.250**	.235**	.419**	.371**	.368**	.225**	.352**	.347**	.317**	.322**	.383**	.300**	.296**
36	.454**	.567**	.476**	.541**	.533**	.485**	.476**	.531**	.523**	.357**	.578**	.527**	.457**	.375**	.427**	.443**	.474**	.452**	.611**	.539**	.467**
37	.493**	.545**	.437**	.494**	.550**	.480**	.510**	.481**	.487**	.322**	.510**	.516**	.458**	.395**	.427**	.419**	.450**	.493**	.497**	.468**	.438**
38	.386**	.501**	.482**	.503**	.539**	.387**	.396**	.491**	.450**	.344**	.536**	.533**	.466**	.408**	.473**	.412**	.484**	.422**	.540**	.451**	.458**
39	.471**	.538**	.420**	.439**	.508**	.386**	.447**	.463**	.442**	.398**	.452**	.513**	.486**	.432**	.488**	.428**	.463**	.483**	.497**	.408**	.477**
40	.414**	.456**	.317**	.283**	.400**	.290**	.318**	.367**	.351**	.312**	.424**	.332**	.481**	.451**	.471**	.380**	.442**	.482**	.458**	.385**	.483**
41	.310**	.349**	.280**	.235**	.322**	.245**	.231**	.268**	.319**	.358**	.342**	.356**	.410**	.419**	.442**	.397**	.435**	.413**	.400**	.304**	.473**
42	.377**	.420**	.329**	.330**	.400**	.370**	.334**	.421**	.330**	.327**	.433**	.332**	.524**	.474**	.474**	.428**	.507**	.575**	.567**	.482**	.530**
43	.349**	.344**	.175**	.173**	.342**	.171**	.270**	.325**	.230**	.282**	.266**	.229**	.379**	.372**	.409**	.357**	.439**	.426**	.403**	.326**	.431**

****Correlation is significant at the 0.01 level (2-tailed).**

	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
22	1																					
23	.744**	1																				
24	.645**	.673**	1																			
25	.652**	.669**	.741**	1																		
26	.651**	.612**	.791**	.718**	1																	
27	.643**	.650**	.677**	.705**	.716**	1																
28	.577**	.567**	.401**	.447**	.458**	.478**	1															
29	.551**	.498**	.389**	.418**	.426**	.438**	.822**	1														
30	.527**	.510**	.434**	.370**	.432**	.417**	.705**	.691**	1													
31	.526**	.537**	.446**	.400**	.403**	.441**	.784**	.781**	.884**	1												
32	.533**	.483**	.453**	.484**	.428**	.437**	.509**	.432**	.427**	.502**	1											
33	.601**	.576**	.576**	.495**	.558**	.548**	.485**	.460**	.482**	.494**	.657**	1										
34	.405**	.477**	.564**	.441**	.412**	.422**	.329**	.242**	.396**	.368**	.643**	.654**	1									
35	.487**	.372**	.416**	.396**	.347**	.384**	.395**	.332**	.391**	.379**	.717**	.604**	.710**	1								
36	.579**	.479**	.533**	.524**	.486**	.484**	.481**	.395**	.526**	.485**	.643**	.581**	.552**	.573**	1							
37	.553**	.481**	.566**	.582**	.447**	.476**	.449**	.427**	.488**	.493**	.591**	.582**	.613**	.530**	.767**	1						
38	.605**	.440**	.559**	.531**	.507**	.512**	.425**	.433**	.515**	.492**	.645**	.601**	.533**	.597**	.807**	.749**	1					
39	.574**	.566**	.571**	.582**	.507**	.507**	.468**	.480**	.460**	.475**	.610**	.601**	.608**	.563**	.656**	.768**	.705**	1				
40	.481**	.435**	.489**	.465**	.495**	.472**	.400**	.375**	.392**	.361**	.449**	.534**	.483**	.483**	.469**	.522**	.510**	.605**	1			
41	.376**	.357**	.514**	.453**	.514**	.498**	.364**	.329**	.373**	.308**	.476**	.460**	.500**	.496**	.457**	.421**	.509**	.509**	.735**	1		
42	.477**	.504**	.547**	.539**	.553**	.621**	.435**	.357**	.441**	.389**	.537**	.601**	.602**	.583**	.567**	.530**	.552**	.541**	.800**	.784**	1	
43	.402**	.384**	.429**	.454**	.413**	.509**	.412**	.376**	.337**	.330**	.340**	.444**	.450**	.485**	.328**	.413**	.358**	.427**	.662**	.632**	.687**	1

**Correlation is significant at the 0.01 level (2-tailed).

Legend:1 Acts as change leader, 2 Vision & mission echo the principles of lean thinking leader, 3 Inclination on quality rather than cost, 4 Resources and time allocation for Lean, 5 Understanding of Lean activities and practices,6 Willingness and motivation for change, 7 Organisation culture is supportive of lean, 8 Employees as partners, 9 Trainings in lean tools, problem identification etc. 10 Trainings in interactive / social skills, 11 Multi skilled employees and cross functional teams,12 Employees empowerment, 13 Voice of Customer, 14 Customers' periodic surveys /feedbacks etc., 15 Extensive customer service program, 16 Comprehensive database of customers, 17 Current/future state analysis using VSM, 18 Visualisation of process maps and updating them, 19 Eliminating/reducing wastes, 20 Producing defect free services, 21 Quality of input, 22 Periodic meetings to discuss continuous improvement, 22 Processes have continuous flow, 23 Clearly defined and standardised processes , 24 Measuring all key process metrics, 25 Structured, well defined action plan for problem solving and process improvement, 26 Using continuous improvement tools, 27 Suppliers as partners, 28 Training programmes for suppliers, 29 Supplier selection based on value addition and not only on cost, 30 Extensive supplier management programme, 31 Locating and sharing information as needed, 32 Managing accuracy, timeliness, relevance, quantity and form of information, 33 Use of reliable & thoroughly tested technology, 34Enhancing technological capability to serve customers better, 35 Enhancing the knowledge base for lean , 36 Developing new/innovative services and practices, 37 Transforming tacit knowledge into explicit organisational knowledge, 39 Capturing , reviewing, standardising and sharing learning , best practices etc., 40 Comfortable, clean physical environment and ambient conditions., 41 Equipments, physical facilities, signboards etc. to educate and influence customers, 42 Physical layout, facilities etc. support uninterrupted flow, 43 Employees with pleasing and neat appearance for quality assurance.

Factor Analysis: Lean Practices

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.926
Bartlett's Test of Sphericity	Approx. Chi-Square	11783.305
	df	903
	Sig.	.000

Communalities

	Initial	Extraction
Acts as change leader	1.000	.698
Vision & mission echo the principles of lean thinking leader	1.000	.777
Inclination on quality rather than cost .	1.000	.721
Resources and time allocation for Lean.	1.000	.713
Understanding of Lean activities and practices	1.000	.803
Willingness and motivation for change.	1.000	.554
Organisation culture is supportive of lean.	1.000	.781
Employees as partners.	1.000	.721
Trainings in lean tools, problem identification etc.	1.000	.720
Trainings in interactive / social skills.	1.000	.728
Multi skilled employees and cross functional teams.	1.000	.659
Employees empowerment	1.000	.616
Voice of Customer	1.000	.791
Customers' periodic surveys /feedbacks etc.	1.000	.843
Extensive customer service program.	1.000	.791
Comprehensive database of customers.	1.000	.635
Current/future state analysis using VSM.	1.000	.769
Visualisation of process maps and updating them.	1.000	.721
Eliminating/reducing wastes	1.000	.825
Producing defect free services.	1.000	.636
Quality of input	1.000	.681
Periodic meetings to discuss continuous improvement.	1.000	.726
Processes have continuous flow	1.000	.758
Clearly defined and standardised processes.	1.000	.789
Measuring all key process metrics.	1.000	.774
Structured, well defined action plan for problem solving and process improvement.	1.000	.818
Using continuous improvement tools	1.000	.755
Suppliers as partners.	1.000	.822
Training programmes for suppliers.	1.000	.847
Supplier selection based on value addition & not only on cost.	1.000	.795
Extensive supplier management programme.	1.000	.876
Locating and sharing information as needed	1.000	.724
Managing accuracy, timeliness, relevance, quantity and form of information.	1.000	.672
Use of reliable & thoroughly tested technology	1.000	.757
Enhancing technological capability to serve customers better	1.000	.764
Enhancing the knowledge base for lean .	1.000	.783
Developing new/innovative services and practices.	1.000	.720
Transforming tacit knowledge into explicit organisational knowledge	1.000	.769
Capturing , reviewing, standardising and sharing learning , best practices etc.	1.000	.675
Comfortable, clean physical environment and ambient conditions.	1.000	.775

	Initial	Extraction
Equipments, physical facilities, signboards etc. to educate and influence customers.	1.000	.756
Physical layout, facilities etc. support uninterrupted flow.	1.000	.828
Employees with pleasing and neat appearance for quality assurance.	1.000	.766

Extraction Method: Principal Component Analysis

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	19.951	46.397	46.397	19.951	46.397	46.397	5.200	12.092	12.092
2	2.887	6.715	53.112	2.887	6.715	53.112	4.713	10.960	23.052
3	2.172	5.050	58.162	2.172	5.050	58.162	4.643	10.797	33.849
4	1.982	4.610	62.772	1.982	4.610	62.772	4.014	9.334	43.184
5	1.529	3.555	66.327	1.529	3.555	66.327	3.849	8.951	52.135
6	1.294	3.010	69.337	1.294	3.010	69.337	3.585	8.338	60.472
7	1.285	2.987	72.325	1.285	2.987	72.325	3.185	7.406	67.878
8	1.030	2.396	74.720	1.030	2.396	74.720	2.942	6.842	74.720
9	.861	2.003	76.723						
10	.814	1.894	78.617						
11	.704	1.638	80.255						
12	.628	1.460	81.716						
13	.596	1.386	83.102						
14	.554	1.288	84.390						
15	.514	1.196	85.586						
16	.508	1.182	86.768						
17	.476	1.108	87.875						
18	.433	1.008	88.883						
19	.408	.949	89.832						
20	.357	.831	90.663						
21	.348	.809	91.472						
22	.321	.748	92.220						
23	.286	.665	92.884						
24	.274	.637	93.522						
25	.263	.613	94.135						
26	.249	.578	94.713						
27	.226	.525	95.237						
28	.219	.508	95.746						
29	.192	.446	96.192						
30	.179	.416	96.608						
31	.164	.381	96.988						
32	.161	.375	97.363						
33	.152	.353	97.716						

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**		**Total**	**% of Variance**	**Cumulative %**		**Total**
34	.137	.320	98.036						
35	.130	.302	98.338						
36	.125	.292	98.630						
37	.110	.256	98.885						
38	.105	.245	99.130						
39	.098	.228	99.358						
40	.085	.199	99.557						
41	.075	.174	99.731						
42	.066	.154	99.885						
43	.050	.115	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

	Component							
	1	2	3	4	5	6	7	8
Acts as change leader				.686				
Vision & mission echo the principles of lean thinking leader				.675				
Inclination on quality rather than cost.				.708				
Resources and time allocation for Lean.				.649				
Understanding of Lean activities and practices				.736				
Willingness and motivation for change.			.579					
Organisation culture is supportive of lean.			.682	.475				
Employees as partners.			.649					
Trainings in lean tools, problem identification etc.			.700					
Trainings in interactive / social skills.			.762					
Multi skilled employees and cross functional teams.			.525					
Employees empowerment			.552					
Voice of Customer								.630
Customers' periodic surveys /feedbacks etc.								.790
Extensive customer service program.								.741
Comprehensive database of customers.								.556
Current/future state analysis using VSM.							.640	
Visualisation of process maps and updating them.							.592	
Eliminating/reducing wastes							.681	
Producing defect free services.							.587	
Quality of input							.510	
Periodic meetings to discuss continuous improvement.		.602						
Processes have continuous flow		.684						
Clearly defined and standardised processes.		.735						
Measuring all key process metrics		.709						
Structured, well defined action plan for problem solving and process improvement.		.740						

Component	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Using continuous improvement tools		.661						
Suppliers as partners.					.786			
Training programmes for suppliers.					.823			
Supplier selection based on value addition and not only on cost.					.738			
Extensive supplier management programme.					.800			
Locating and sharing information as needed	.697							
Managing accuracy, timeliness, relevance, quantity and form of information.	.566							
Use of reliable & thoroughly tested technology	.701							
Enhancing technological capability to serve customers better	.755							
Enhancing the knowledge base for lean .	.638							
Developing new/innovative services and practices.	.622							
Transforming tacit knowledge into explicit organisational knowledge	.662							
Capturing , reviewing, standardising and sharing learning , best practices etc.	.569							
Comfortable, clean physical environment and ambient conditions.						.721		
Equipments, physical facilities, signboards etc. to educate and influence customers.						.735		
Physical layout, facilities etc. support unint. Flow.						.691		
Employees with pleasing and neat appearance for quality assurance.						.795		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 11 iterations.

Factor Analysis: Operational Performance

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.927
Bartlett's Test of Sphericity	Approx. Chi-Square	1812.390
	df	28
	Sig.	.000

Communalities

	Initial	Extraction
Wastes Reduction	1.000	.722
Costs Reduction	1.000	.693
Resource Utilisation	1.000	.787
Quality	1.000	.724
Delivery	1.000	.765
Flexibility	1.000	.687
Customer Satisfaction	1.000	.690
Innovation	1.000	.582

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.650	70.622	70.622	5.650	70.622	70.622
2	.554	6.928	77.550			
3	.492	6.151	83.700			
4	.366	4.572	88.272			
5	.305	3.814	92.087			
6	.226	2.828	94.915			
7	.220	2.750	97.665			
8	.187	2.335	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Wastes Reduction	.850
Costs Reduction	.832
Resource Utilisation	.887
Quality	.851
Delivery	.875
Flexibility	.829
Customer Satisfaction	.831
Innovation	.763

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Factor Analysis: Top Management Commitment

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.826
Bartlett's Test of Sphericity	Approx. Chi-Square	789.730
	df	10
	Sig.	.000

Communalities

	Initial	Extraction
Acts as change leader	1.000	.660
Vision & mission echo the principles of lean thinking leader	1.000	.697
Inclination on quality rather than cost.	1.000	.641
Resources and time allocation for Lean.	1.000	.666
Understanding of Lean activities and practices	1.000	.761

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.425	68.500	68.500	3.425	68.500	68.500
2	.649	12.983				
3	.377	7.549				
4	.323	6.461				
5	.225	4.506				

Component Matrix[a]

	Component
	1
Acts as change leader	.812
Vision & mission echo the principles of lean thinking leader	.835
Inclination on quality rather than cost.	.801
Resources and time allocation for Lean.	.816
Understanding of Lean activities and practices	.872

Extraction Method: Principal Component Analysis.[a]

a. 1 components extracted.

Factor Analysis: Human Resource and Change Management

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.871
Bartlett's Test of Sphericity	Approx. Chi-Square	1197.759
	df	21
	Sig.	.000

Communalities

	Initial	Extraction
Willingness and motivation for change.	1.000	.581
Organisation culture is supportive of lean.	1.000	.691
Employees as partners.	1.000	.714
Trainings in lean tools, problem identification etc.	1.000	.709
Trainings in interactive / social skills.	1.000	.610
Multi skilled employees and cross functional teams.	1.000	.565
Employees empowerment	1.000	.590

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.461	63.727	63.727	4.461	63.727	63.727
2	.679	9.702	73.430			
3	.577	8.238	81.668			
4	.462	6.596	88.264			
5	.400	5.717	93.981			
6	.224	3.206	97.187			
7	.197	2.813	100.000			

Component Matrix[a]

	Component
	1
Willingness and motivation for change.	.762
Organisation culture is supportive of lean.	.832
Employees as partners.	.845
Trainings in lean tools, problem identification etc.	.842
Trainings in interactive / social skills.	.781
Multi skilled employees and cross functional teams.	.752
Employees empowerment	.768

Extraction Method: Principal Component Analysis.[a] a. 1 components extracted.

Factor Analysis: Customer Relationship Management

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.871
Bartlett's Test of Sphericity	Approx. Chi-Square	628.439
	df	6
	Sig.	.000

Communalities

	Initial	Extraction
Voice of Customer	1.000	.797
Customers' periodic surveys /feedbacks etc.	1.000	.812
Extensive customer service program.	1.000	.753
Comprehensive database of customers.	1.000	.574

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.935	73.383	73.383	2.935	73.383	73.383
2	.542	13.549	86.932			
3	.274	6.857	93.790			
4	.248	6.210	100.000			

Component Matrix[a]

	Component
	1
Voice of Customer	.893
Customers' periodic surveys /feedbacks etc.	.901
Extensive customer service program.	.868
Comprehensive database of customers.	.758

Extraction Method: Principal Component Analysis.[a] a. 1 components extracted.

Factor Analysis: Elimination of Waste

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.827
Bartlett's Test of Sphericity	Approx. Chi-Square	791.796
	df	10
	Sig.	.000

Communalities

	Initial	Extraction
Current/future state analysis using VSM.	1.000	.749
Visualisation of process maps and updating them.	1.000	.721
Eliminating/reducing wastes	1.000	.786
Producing defect free services.	1.000	.554
Quality of input	1.000	.554

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.364	67.285	67.285	3.364	67.285	67.285
2	.704	14.078	81.364			
3	.436	8.729	90.092			
4	.299	5.990	96.082			
5	.196	3.918	100.000			

Component Matrix[a]

	Component
	1
Current/future state analysis using VSM.	.866
Visualisation of process maps and updating them.	.849
Eliminating/reducing wastes	.886
Producing defect free services.	.744
Quality of input	.745

Extraction Method: Principal Component Analysis.[a] a. 1 components extracted.

Factor Analysis: Continuous Process Improvement

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.898
Bartlett's Test of Sphericity	Approx. Chi-Square	1290.121
	df	15
	Sig.	.000

Communalities

	Initial	Extraction
Periodic meetings to discuss continuous improvement.	1.000	.703
Processes have continuous flow	1.000	.708
Clearly defined and standardised processes.	1.000	.775
Measuring all key process metrics	1.000	.759
Structured, well defined action plan for problem solving and process improvement.	1.000	.761
Using continuous improvement tools	1.000	.725

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.430	73.836	73.836	4.430	73.836	73.836
2	.498	8.292	82.128			
3	.335	5.582	87.710			
4	.296	4.933	92.643			
5	.258	4.304	96.947			
6	.183	3.053	100.000			

Component Matrix[a]

	Component 1
Periodic meetings to discuss continuous improvement.	.839
Processes have continuous flow	.841
Clearly defined and standardised processes.	.880
Measuring all key process metrics	.871
Structured, well defined action plan for problem solving and process improvement.	.872
Using continuous improvement tools	.851

Extraction Method: Principal Component Analysis.[a] a. 1 components extracted.

Factor Analysis: Supplier Management

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.792
Bartlett's Test of Sphericity	Approx. Chi-Square	1063.730
	df	6
	Sig.	.000

Communalities

	Initial	Extraction
Suppliers as partners.	1.000	.821
Training programmes for suppliers.	1.000	.812
Supplier selection based on value addition .	1.000	.807
Extensive supplier management programme.	1.000	.895

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.335	83.367	83.367	3.335	83.367	83.367
2	.386	9.643	93.010			
3	.178	4.450	97.460			
4	.102	2.540	100.000			

Component Matrix[a]

	Component
	1
Suppliers as partners.	.906
Training programmes for suppliers.	.901
Supplier selection based on value addition and not only on cost.	.898
Extensive supplier management programme.	.946

Extraction Method: Principal Component Analysis.[a]

a. 1 components extracted.

Factor Analysis: Information, Technology and Knowledge Management

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.907
Bartlett's Test of Sphericity	Approx. Chi-Square	1770.346
	df	28
	Sig.	.000

Communalities

	Initial	Extraction
Locating and sharing information as needed	1.000	.692
Managing accuracy, timeliness, relevance, quantity and form of information.	1.000	.633
Use of reliable & thoroughly tested technology	1.000	.639
Enhancing technological capability to serve customers better	1.000	.635
Enhancing the knowledge base for lean.	1.000	.717
Developing new/innovative services and practices.	1.000	.723
Transforming tacit knowledge into explicit organisational knowledge	1.000	.733
Capturing , reviewing, standardising and sharing learning , best practices etc.	1.000	.697

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.469	68.362	68.362	5.469	68.362	68.362
2	.769	9.618	77.979			
3	.444	5.544	83.524			
4	.393	4.917	88.441			
5	.310	3.880	92.321			
6	.260	3.244	95.566			
7	.186	2.324	97.890			
8	.169	2.110	100.000			

Component Matrix[a]

	Component 1
Locating and sharing information as needed	.832
Managing accuracy, timeliness, relevance, quantity & form of information.	.795
Use of reliable & thoroughly tested technology	.800
Enhancing technological capability to serve customers better	.797
Enhancing the knowledge base for lean .	.847
Developing new/innovative services and practices.	.850
Transforming tacit knowledge into explicit organisational knowledge	.856
Capturing , reviewing, standardising & sharing learning , best practices	.835

Extraction Method: Principal Component Analysis.[a] a. 1 components extracted.

Factor Analysis: Servicescapes

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.844
Bartlett's Test of Sphericity	Approx. Chi-Square	789.220
	df	6
	Sig.	.000

Communalities

	Initial	Extraction
Comfortable, clean physical environment and ambient conditions.	1.000	.815
Equipments, physical facilities, signboards etc. to educate and influence customers.	1.000	.790
Physical layout, facilities etc. support uninterrupted flow.	1.000	.854
Employees with pleasing and neat appearance for quality assurance.	1.000	.694

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.154	78.857	78.857	3.154	78.857	78.857
2	.396	9.889	88.746			
3	.263	6.581	95.327			
4	.187	4.673	100.000			

Component Matrix[a]

	Component 1
Comfortable, clean physical environment and ambient conditions.	.903
Equipments, physical facilities, signboards etc. to educate and influence customers.	.889
Physical layout, facilities etc. support uninterrupted flow.	.924
Employees with pleasing and neat appearance for quality assurance.	.833

Extraction Method: Principal Component Analysis.[a] a. 1 components extracted.

Regression Analysis

Descriptive Statistics

	Mean	Std. Deviation	N
Operational Performance	3.8532425	.70979316	286
Information, Technology and Knowledge Management	3.8761814	.72923409	286
Servicescapes	4.0212277	.70778261	286
Supplier Management	3.4321064	.98637171	286
Customer Relationship Management	4.0672247	.75649105	286
Elimination of Waste	3.7974268	.77377985	286
Continuous Process Improvement	3.9425280	.78521258	286
Top Management Commitment	3.8372393	.84054453	286
Human Resource and Change Management	3.7222878	.78302124	286

Multiple Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.769[a]	.591	.590	.45458967	.591	410.815	1	284	.000	
2	.843[b]	.710	.708	.38368422	.119	115.666	1	283	.000	
3	.861[c]	.741	.738	.36348202	.031	33.332	1	282	.000	
4	.870[d]	.757	.753	.35242827	.016	18.967	1	281	.000	
5	.873[e]	.763	.759	.34868768	.006	7.061	1	280	.008	2.024

a. Predictors: (Constant), Information, Technology and Knowledge Management

b. Predictors: (Constant), Information, Technology and Knowledge Management, Elimination of Waste

c. Predictors: (Constant), Information, Technology and Knowledge Management, Elimination of Waste, Supplier Management

d. Predictors: (Constant), Information, Technology and Knowledge Management, Elimination of Waste, Supplier Management, Continuous Process Improvement

e. Predictors: (Constant), Information, Technology and Knowledge Management, Elimination of Waste, Supplier Management, Continuous Process Improvement, Servicescapes

f. Dependent Variable: Operational Performance

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.952	.146		6.538	.000		
	ITKM	.748	.037	.769	20.269	.000	1.000	1.000
2	(Constant)	.479	.131		3.672	.000		
	ITKM	.465	.041	.478	11.406	.000	.584	1.713
	EOW	.413	.038	.451	10.755	.000	.584	1.713
3	(Constant)	.514	.124		4.148	.000		
	ITKM	.393	.041	.404	9.691	.000	.529	1.891
	EOW	.326	.039	.356	8.282	.000	.498	2.007
	SPM	.167	.029	.233	5.773	.000	.566	1.766
4	(Constant)	.416	.122		3.410	.001		
	ITKM	.323	.043	.332	7.599	.000	.453	2.208
	EOW	.245	.043	.267	5.748	.000	.402	2.491
	SPM	.149	.028	.208	5.258	.000	.554	1.804
	CPI	.188	.043	.208	4.355	.000	.379	2.638
5	(Constant)	.293	.129		2.266	.024		
	ITKM	.282	.045	.289	6.270	.000	.398	2.514
	EOW	.221	.043	.241	5.138	.000	.384	2.601
	SPM	.151	.028	.210	5.377	.000	.554	1.805
	CPI	.168	.043	.186	3.882	.000	.368	2.718
	SS	.111	.042	.110	2.657	.008	.490	2.041

Legend: EOW: Elimination of Waste, CPI: Continuous Process Improvement, SM: Supplier Management, ITKM: Information, Technology and Knowledge Management, SS: Servicescapes

Excluded Variables

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
5	Customer Relationship Management	.023[f]	.584	.560	.035	.525	1.904	.336
	Top Management Commitment	.018[f]	.449	.653	.027	.534	1.871	.336
	Human Resource and Change Management	.027[f]	.648	.517	.039	.477	2.097	.361

f. Predictors in the Model: (Constant), Information, Technology and Knowledge Management, Elimination of Waste, Supplier Management, Continuous Process Improvement, Servicescapes

Ordinal Regression Analysis

Change in Annual Sales Turnover

Case Processing Summary

		N	Marginal Percentage
Chnge_AnulST	3	56	19.6%
	4	147	51.4%
	5	83	29.0%
Valid		286	100.0%
Missing		1	
Total		287	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	576.563			
Final	552.436	24.127	9	.004

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	556.361	369	.000
Deviance	549.986	369	.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.081
Nagelkerke	.093
McFadden	.041

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	Exp_B	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Threshold	[Chnge_AnulST = 3]	.723	.759	.906	1	.341	-.765	2.210	2.060	0.465	9.118
	[Chnge_AnulST = 4]	3.194	.785	16.555	1	.000	1.655	4.732	24.374	5.234	113.510
Location	TMC	.385	.205	3.540	1	.060	-.016	.787	1.470	0.984	2.196
	HRCM	.009	.244	.001	1	.970	-.469	.487	1.009	0.626	1.628
	CRM	-.107	.221	.237	1	.626	-.540	.325	0.898	0.583	1.384
	EOW	.172	.255	.458	1	.499	-.327	.672	1.188	0.721	1.957
	CPI	.172	.256	.449	1	.503	-.330	.673	1.187	0.719	1.961
	SCM	.296	.172	2.948	1	.086	-.042	.634	1.345	0.959	1.885
	ITKM	-.466	.289	2.610	1	.096	-1.032	.099	0.627	0.356	1.105
	SS	.054	.239	.051	1	.822	-.415	.523	1.055	0.660	1.687
	OP	.106	.330	.103	1	.748	-.540	.752	1.112	0.583	2.121

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	552.436			
General	541.285	11.151	9	.266

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. Link function: Logit.

Trend in Market Share

Case Processing Summary

		N	Marginal Percentage
Trend_MS	3	77	26.9%
	4	153	53.5%
	5	56	19.6%
Valid		286	100.0%
Missing		1	
Total		287	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	566.455			
Final	533.579	32.877	9	.000

Link function: Logit.

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	549.796	369	.000
Deviance	528.284	369	.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.109
Nagelkerke	.125
McFadden	.057

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval		Exp_B	95% Confidence Interval	
							Lower Bound	Upper Bound		Lower Bound	Upper Bound
Threshold	[Trend_MS = 3]	1.310	.771	2.890	1	.089	-.201	2.821	3.707	0.818	16.797
	[Trend_MS = 4]	3.949	.809	23.796	1	.000	2.362	5.535	51.858	10.613	253.396
Location	TMC	.112	.206	.296	1	.587	-.292	.516	1.119	0.747	1.676
	HRCM	-.182	.247	.542	1	.462	-.666	.302	0.834	0.514	1.353
	CRM	-.237	.223	1.122	1	.289	-.674	.201	0.789	0.510	1.223
	EOW	.601	.260	5.332	1	.021	.091	1.111	1.824	1.095	3.036
	CPI	.151	.260	.338	1	.561	-.358	.660	1.163	0.699	1.934
	SCM	.384	.175	4.812	1	.028	.041	.728	1.469	1.042	2.071
	ITKM	-.404	.291	1.930	1	.165	-.974	.166	0.668	0.378	1.181
	SS	.188	.243	.604	1	.437	-.287	.664	1.207	0.751	1.942
	OP	.060	.333	.032	1	.857	-.593	.713	1.062	0.553	2.040

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	533.579			
General	521.989	11.590	9	.237

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. Link function: Logit.

Trend in Profits

Case Processing Summary

		N	Marginal Percentage
Trend_profits	3	65	22.7%
	4	140	49.0%
	5	81	28.3%
Valid		286	100.0%
Missing		1	
Total		287	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	585.937			
Final	533.314	52.623	9	.000

Link function: Logit.

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	601.788	369	.000
Deviance	526.633	369	.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.168
Nagelkerke	.192
McFadden	.088

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval		Exp_B	95% Confidence Interval	
							Lower Bound	Upper Bound		Lower Bound	Upper Bound
Threshold	[Trend_profits = 3]	2.004	.771	6.753	1	.009	.492	3.515	7.418	1.636	33.631
	[Trend_profits = 4]	4.482	.816	30.198	1	.000	2.883	6.080	88.376	17.871	437.037
Location	TMC	.433	.207	4.396	1	.036	.028	.838	1.542	1.029	2.312
	HRCM	-.333	.248	1.802	1	.179	-.820	.153	0.717	0.440	1.166
	CRM	-.117	.223	.274	1	.601	-.554	.320	0.890	0.575	1.378
	EOW	.376	.259	2.106	1	.147	-.132	.885	1.457	0.876	2.422
	CPI	.545	.260	4.374	1	.036	.034	1.055	1.724	1.035	2.872
	SCM	-.042	.174	.058	1	.810	-.383	.300	0.959	0.682	1.349
	ITKM	-.683	.297	5.281	1	.022	-1.266	-.101	0.505	0.282	0.904
	SS	-.436	.246	3.147	1	.076	-.918	.046	0.647	0.400	1.047
	OP	1.157	.348	11.029	1	.001	.474	1.839	3.180	1.607	6.293

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	533.314			
General	513.640	19.674	9	.020

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. Link function: Logit.

Trend in Customer Base

Case Processing Summary

		N	Marginal Percentage
Trend_cust	3	82	28.7%
	4	130	45.5%
	5	74	25.9%
Valid		286	100.0%
Missing		1	
Total		287	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	599.271			
Final	561.088	38.183	9	.000

Link function: Logit.

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	544.385	369	.000
Deviance	555.629	369	.000

Link function: Logit.

Pseudo R-Square

Cox and Snell	.125
Nagelkerke	.142
McFadden	.063

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval		Exp B	95% Confidence Interval	
							Lower Bound	Upper Bound		Lower Bound	Upper Bound
Threshold	[Trend_cust = 3]	2.368	.763	9.627	1	.002	.872	3.865	10.681	2.392	47.683
	[Trend_cust = 4]	4.553	.803	32.162	1	.000	2.980	6.127	94.953	19.682	458.073
Location	TMC	.005	.202	.001	1	.980	-.392	.402	1.005	0.676	1.495
	HRCM	.183	.241	.578	1	.447	-.289	.656	1.201	0.749	1.928
	CRM	.166	.219	.575	1	.448	-.263	.594	1.180	0.769	1.811
	EOW	.628	.256	6.038	1	.014	.127	1.130	1.875	1.136	3.094
	CPI	-.293	.255	1.319	1	.251	-.793	.207	0.746	0.452	1.230
	SCM	.073	.171	.185	1	.667	-.261	.408	1.076	0.770	1.504
	ITKM	-.266	.286	.868	1	.351	-.827	.294	0.766	0.437	1.342
	SS	-.196	.238	.678	1	.410	-.662	.270	0.822	0.516	1.310
	OP	.613	.333	3.391	1	.066	-.040	1.266	1.847	0.961	3.548

Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	561.088			
General	539.267	21.821	9	.009

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. Link function: Logit.

APPENDIX II

Questionnaire 1

Academicians / Practitioners / Organizations have proposed various frameworks for lean management in services which are available in literature. The definition of Lean used for this survey is any good practices of process / operations improvement that have resulted in a reduction of waste, improved the flow and provided a better process views leading to better customer satisfaction. Some of the frameworks were developed by case study using project specific approach or organisation specific approach. They are being used in different parts of world. Eighteen frameworks are available for lean management in services. Hence aim of this study is: **Assessment of reliability and validity of Each Lean Service framework in Indian Service Industry.**

All the information gathered here will be kept strictly confidential and will be used only for research and analysis purposes without mentioning the person or company names.

PART A

1. Name (optional):
2. Name of the Organisation:
3. Position:
4. Experience in years:
5. Phone no & Email Id:
6. Number of employees:
7. Service Sector : a. Healthcare ☐ b. IT/ITES ☐
   c. Banking/ Financial Services ☐ d. Telecom ☐
8. Turnover (in Crores of Rupees):

   a. 0 – 50 b. 51 – 200 c. 201 – 500 d. above 500

9. Does your organization have adopted/implemented any change initiative/quality/process improvement methodology? Yes ☐ No ☐

10. If yes, please indicate which one/s:
    a. Total Quality Management (TQM) ☐ b. ISO 9000 ☐
    c. Lean ☐ d. Six Sigma ☐
    e. Lean Six Sigma ☐ e. Other(s) _____________

11. Based on your perspective what has been the key objective/s for implementing the above selected initiative? (Can be more than one)
    a. To enhance operational excellence / operating performance
    b. To improve service quality
    c. To improve customer satisfaction
    d. To improve net income
    e. To reduce cost
    f. To solve chronic/persistent problem
    g. To remain competitive in the global market
    h. To create better image of service
    i.

12. Have your organisation received any certification in quality/productivity/ customer satisfaction? If yes please mention the certification, agency and the year in which it was awarded.

	Certification	Agency	Year
Quality			
Productivity			
Customer Satisfaction			

13. Have your organisation received any award in quality/customer satisfaction/ productivity? If yes please mention the award, agency and the year in which it was awarded.

	Award	Agency	Year
Quality			
Productivity			
Customer Satisfaction			

14. Please indicate the growth of the organization during the last three years:
    a. Increase more than 30% b. Increase between 20-30%
    c. Increase between 10-20% d. Increase between 0-10%
    e. Decrease between 0-10% f. Decrease between 10-20%
    g. Decrease between 20-30%

15. Is there anything else that has not been covered above that you wish to tell us about change initiative/ strategy/ quality/ process improvement implemented in your organisation?

PART B

Existing Frameworks for Lean Management in Services

Guidelines for filling the questionnaire:

- Please consider each framework individually/ stand alone to achieve lean management in services.
- Please read the framework and its elements carefully and assign the level of importance to the elements of the framework mentioned as per your expertise.
- Please find the explanation of some Lean elements in Annexure A.
- The level of importance given from 1 to 5 wherein:

1: not important 2: less important 3: important 4: more important
5: most important

Framework 1 : Cuatrecasas, A. L. (2002)						
F1.1	Linear flow arrangement : Flexible Cells	1	2	3	4	5
F1.2	Small production batches: a single unit	1	2	3	4	5
F1.3	Rapid preparations	1	2	3	4	5
F1.4	Grouping of tasks by workstation: Conform to given takt time	1	2	3	4	5
F1.5	Versatile personnel	1	2	3	4	5
F1.6	Quality assurance	1	2	3	4	5
F1.7	Preventive Maintenance	1	2	3	4	5

Framework 2 : Comm & Mathaisel, (2003)						
F2.1	Optimize the flow of products & services.	1	2	3	4	5
F2.2	Provide processes for seamless & timely transfer & access to pertinent data &information.	1	2	3	4	5
F2.3	Provide technologies for seamless & timely transfer & access to pertinent data &information.	1	2	3	4	5
F2.4	Optimize the capability & utilization of people.	1	2	3	4	5
F2.5	Implement integrated product & process development	1	2	3	4	5
F2.6	Develop relationships based on mutual trust &	1	2	3	4	5
F2.7	Continuously focus on the customer.	1	2	3	4	5
F2.8	Promote lean thinking at all levels.	1	2	3	4	5
F2.9	Continuous process improvement.	1	2	3	4	5
F2.10	Maximize stability in a changing environment.	1	2	3	4	5

Framework 3 : Ahlstorm (2004)						
F3.1	Elimination of waste	1	2	3	4	5
F3.2	Zero defects	1	2	3	4	5
F3.3	Pull	1	2	3	4	5
F3.4	Continuous Improvement	1	2	3	4	5
F3.5	Multifunctional Teams	1	2	3	4	5
F3.6	Decentralization of responsibilities	1	2	3	4	5
F3.7	Vertical Information system	1	2	3	4	5

Framework 4 : Apte & Goh (2004)						
F4.1	Identifying, enhancing & implementing value	1	2	3	4	5
F4.2	Effective management of supplier relations and information flow.	1	2	3	4	5
F4.3	Elimination of waste	1	2	3	4	5
F4.4	Appropriate matching of service capacity to customer-driven demand	1	2	3	4	5
F4.5	Continuous improvement (kaizen)	1	2	3	4	5

Framework 5 : Sa´nchez & Pe´rez (2004)						
F5.1	Elimination of zero-value activities	1	2	3	4	5
F5.2	Continuous improvement	1	2	3	4	5
F5.3	Multifunctional teams	1	2	3	4	5
F5.4	JIT delivery	1	2	3	4	5
F5.5	Suppliers involvement	1	2	3	4	5
F5.6	Flexible information system.	1	2	3	4	5

Framework 6 : Kollberg, Dahlgaard, & Brehmer (2007)						
F6.1	Waiting time at specific points in processes.	1	2	3	4	5
F6.2	Patient/ Customer satisfaction	1	2	3	4	5
F6.3	Referral management	1	2	3	4	5
F6.4	Process mapping	1	2	3	4	5
F6.5	Fulfilment of targets and policies.	1	2	3	4	5

Framework 7 : Sarkar, 2008						
F7.1	Leadership	1	2	3	4	5
F7.2	Functions	1	2	3	4	5
F7.3	Value Streams	1	2	3	4	5
F7.4	Anchors (People, Processes, Partners, Promotions & Problem Solving)					
F7.4.1	People	1	2	3	4	5
F7.4.2	Processes	1	2	3	4	5
F7.4.3	Partners	1	2	3	4	5
F7.4.4	Promotions	1	2	3	4	5
F7.4.5	Problem Solving	1	2	3	4	5
F7.5	Lean Thinking	1	2	3	4	5
F7.6	Results	1	2	3	4	5

Framework 8 : Radnor (2010)						
F8.1	Understanding demand and capacity	1	2	3	4	5
F8.2	Understanding value	1	2	3	4	5
F8.3	Having a process view	1	2	3	4	5
F8.4	Linking activity to the Strategy	1	2	3	4	5
F8.5	Strong committed leadership	1	2	3	4	5

Framework 8 : Radnor (2010)						
F8.6	Communication strategy	1	2	3	4	5
F8.7	Training and development	1	2	3	4	5
F8.8	Steering group and project team	1	2	3	4	5

Framework 9 : Dahlgaard, J. J. et al. (2011)						
F9.1	Leadership	1	2	3	4	5
F9.2	Cultural Change	1	2	3	4	5
F9.3	People Management	1	2	3	4	5
F9.4	Partnerships	1	2	3	4	5
F9.5	Processes	1	2	3	4	5
F9.6	Product/Service Results	1	2	3	4	5
F9.7	Policy Deployment	1	2	3	4	5
F9.8	Waste Reduction	1	2	3	4	5
F9.9	Root Cause Analysis	1	2	3	4	5

Framework 10: Bonaccorsi, A. et al.(2011)						
F10.1	Top Management Commitment	1	2	3	4	5
F10.2	Employee Engagement	1	2	3	4	5
F10.3	Team Work	1	2	3	4	5
F10.4	Training and Learning	1	2	3	4	5
F10.5	Voice of Customer	1	2	3	4	5
F10.6	Value Stream Mapping	1	2	3	4	5
F10.7	Focus on Flow	1	2	3	4	5
F10.8	Focus on Levelling	1	2	3	4	5

Framework 11 : Bonneau, N. (2011)						
F11.1	Process Improvement	1	2	3	4	5
F11.2	Waste identification and elimination	1	2	3	4	5
F11.3	Problem Solving	1	2	3	4	5
F11.4	People and partner	1	2	3	4	5
F11.5	Voice of Customer	1	2	3	4	5
F11.6	Value Stream Mapping	1	2	3	4	5
F11.7	Kaizen	1	2	3	4	5
F11.8	Heijunka Scheduling	1	2	3	4	5

Framework 12 : Kuusela, R., & Koivuluoma, M. (2011)						
F12.1	Top Management Commitment	1	2	3	4	5
F12.2	Value for stakeholders.	1	2	3	4	5
F12.3	Focus on value stream	1	2	3	4	5
F12.4	Cultural and organisational development	1	2	3	4	5
F12.5	Training	1	2	3	4	5

Framework 12 : Kuusela, R., & Koivuluoma, M. (2011)						
F12.6	Value Stream Mapping	1	2	3	4	5
F12.7	Kaizen	1	2	3	4	5
F12.8	Lean Assessment	1	2	3	4	5

Framework 13 : Kreuzer, E. et al. (2011)						
F13.1	Customer service requirements analysis	1	2	3	4	5
F13.2	Process description and modeling	1	2	3	4	5
F13.3	Value Stream Mapping	1	2	3	4	5
F13.4	Service performance measurement	1	2	3	4	5
F13.5	Optimisation & service performance improvement	1	2	3	4	5
F13.6	Continuous Improvement	1	2	3	4	5

Framework 14: TCS O-PERA (Optimize- Process, Efficiency, Results Assurance) (2011).						
F14.1	Focus on Customer	1	2	3	4	5
F14.2	People	1	2	3	4	5
F14.3	Process	1	2	3	4	5
F14.4	Technology	1	2	3	4	5
F14.5	Shared Services	1	2	3	4	5
F14.6	Knowledge Management	1	2	3	4	5
F14.7	Continuous Optimization	1	2	3	4	5
F14.8	Efficiency Focus	1	2	3	4	5

Framework 15: Guimarães, C. M., & De Carvalho, J. C. (2012)						
F15.1	Transformational Leadership	1	2	3	4	5
F15.2	Willingness to change	1	2	3	4	5
F15.3	Emotional Competence	1	2	3	4	5
F15.4	Satisfaction with change	1	2	3	4	5
F15.5	Relational Competence	1	2	3	4	5
F15.6	Effective Communication	1	2	3	4	5
F15.7	Tools & Techniques Training	1	2	3	4	5
F15.8	Information Seamless Flow	1	2	3	4	5
F15.9	Material Seamless Flow	1	2	3	4	5
F15.10	People Seamless Flow	1	2	3	4	5
F15.11	Lean Sensei	1	2	3	4	5
F15.12	Value Stream Achievements	1	2	3	4	5
F15.13	Trust Building	1	2	3	4	5
F15.14	Emotional Commitment	1	2	3	4	5
F15.15	Lean Values	1	2	3	4	5
F15.16	Technical Innovation	1	2	3	4	5
F15.17	Inter Organisation Achievement	1	2	3	4	5

Framework 16: Damrath, F. (2012)						
F16.1	Value Stream Mapping	1	2	3	4	5
F16.2	Standardize processes	1	2	3	4	5
F16.3	Continuous Improvement	1	2	3	4	5
F16.4	Senior Management Support	1	2	3	4	5
F16.5	Create Flow	1	2	3	4	5
F16.6	Waste identification and elimination	1	2	3	4	5
F16.7	Structured Knowledge Sharing	1	2	3	4	5
F16.8	Quality Circles	1	2	3	4	5
F16.9	Structured Problem Solving	1	2	3	4	5
F16.10	Heijunka Scheduling	1	2	3	4	5

Framework 17 : Kundu & Manohar, (2012)						
F17.1	Organization value and culture	1	2	3	4	5
F17.2	Knowledge management	1	2	3	4	5
F17.3	Technology management	1	2	3	4	5
F17.4	Capacity and availability management	1	2	3	4	5
F17.5	Causal analysis and resolution	1	2	3	4	5
F17.6	Continuous improvement	1	2	3	4	5
F17.7	Organizational training	1	2	3	4	5
F17.8	Supplier agreement and management	1	2	3	4	5
F17.9	Customer connection	1	2	3	4	5
F17.10	Value stream	1	2	3	4	5
F17.11	Visual control[+]	1	2	3	4	5

Framework18 : Malmbrandt & Ahlstrom, 2013						
F18.1	Employee commitment & understanding.	1	2	3	4	5
F18.2	Employee training,	1	2	3	4	5
F18.3	Management commitment and understanding.	1	2	3	4	5
F18.4	Infrastructural elements	1	2	3	4	5
F18.5	Customer value.	1	2	3	4	5
F18.6	Identify waste.	1	2	3	4	5
F18.7	Flow.	1	2	3	4	5
F18.8	Standardisation	1	2	3	4	5
F18.9	Level and balance workloads.	1	2	3	4	5
F18.10	Zero Defects	1	2	3	4	5
F18.11	Pull	1	2	3	4	5
F18.12	Visualization	1	2	3	4	5
F18.13	Multifunctional employees	1	2	3	4	5
F18.14	Continuous improvement.	1	2	3	4	5

Questionnaire II

QUESTIONNAIRE (Consultant)

PART A: COMPANY PARTICULARS

Name of the Organisation:	
Address	
Website	
Number of employees:	a) 1-20 b) 21- 50 c) 51- 100 d) more than 100
Type of Organisation:	Private/ Public Ltd/ Semi Government /Public
Organisation's annual sales turnover (in Crores of Rupees):	a. 0 – 50 b. 51 – 100 c. 101 – 200 d. above 200
Name (optional):	
Designation:	
Phone no / Email Id	
Experience in Years	
Experience in Lean in Years	
Service Sector/s in which lean has been applied by you	a) Banking/ Financial Services b) Healthcare c) IT/ITES d) Telecom e) Others (Please Mention)____________________

1. Does your organization have adopted/implemented any change initiative/ quality/ process improvement methodology?

   Yes ☐ No ☐

2. If yes, please indicate which one/s:

a. Total Quality Management (TQM) ☐ b. ISO 9000 ☐

c. Lean ☐ d. Six Sigma ☐

e. Lean Six Sigma ☐ f. Other(s) _________________________

3. Based on your perspective what has been the key objective/s for implementing the above selected initiatives in different organisations? (Can be more than one/ Kindly rank them with rank 1 as the most important)

a. To enhance operational excellence / operating performance ☐
b. To improve service quality ☐
c. To improve customer satisfaction ☐
d. To improve net income ☐
e. To reduce cost ☐
f. To solve chronic/persistent problem ☐
g. To remain competitive in the global market ☐
h. To create better image of service ☐

4. Please indicate on an average change in annual sales turnover after the inception of Lean/Change Initiative/Process Improvement Methodology in any service organisation:

   a. Decrease more than 10% b. Decrease up to10% c. No change

d. Increase up to 10%   e. Increase more than 10%

5. Please indicate on an average change in market share after the inception of Lean/Change Initiative/Process Improvement Methodology in any service organisation:

   a. Decrease more than 10%   b. Decrease up to10%   c. No change

   d. Increase up to 10%   e. Increase more than 10%

6. Please indicate on an average change in profits after the inception of Lean/Change Initiative/Process Improvement Methodology in any service organisation:

   a. Decrease more than 10%   b. Decrease up to10%   c. No change

   d. Increase up to 10%   e. Increase more than 10%

7. Please indicate on an average change in customer base after the inception of Lean/Change Initiative/Process Improvement Methodology in any service organisation:

   a. Decrease more than 10%   b. Decrease up to10%   c. No change

   d. Increase up to 10%   e. Increase more than 10%

8. Please indicate the which of the following tools/practices are being used for implementing Lean in different organisations

a. 5s	☐	b. Visual Management	☐
c. Pareto Analysis	☐	d. Value Stream Mapping	☐
e. Waste Reduction	☐	f. Cross functional teams	☐
g. One piece flow	☐	g. Kaizen Workshop	☐
h. Standardisation	☐	h. Cause & Effect Analysis	☐

9. Any Suggestions regarding lean /change initiative/ strategy/ quality/ process improvement in services

PART B

Follow survey questionnaire for validity and reliability of proposed initiatives and practices for achieving Lean in services. Kindly fill the questionnaire as per your expertise and knowledge related to Lean practices being implemented by you in service organisation.
The item scales are on five-point Likert scales with:
1 = very low, 2 = low, 3=medium, 4= high, 5=very high

TOP MANAGEMENT COMMITMENT

Kindly rate the degree or level of importance of each initiative related to TOP MANAGEMENT COMMITMENT as an enabler to achieve Lean in any service organisation.		Very Low ⟷ Very High				
TMC 1	Top Management acts as change leader.	1	2	3	4	5
TMC 2	Lean Thinking is intertwined with strategic planning & organisation's vision & mission echo the principles of lean thinking.	1	2	3	4	5
TMC 3	Top management has inclination on quality rather than cost	1	2	3	4	5
TMC 4	Top Management allocates resources and time for Lean	1	2	3	4	5
TMC 5	Top Management has thorough understanding of Lean activities and practices Lean	1	2	3	4	5

HR & CHANGE MANAGEMENT

Kindly rate the degree or level of importance of each initiative related to HR & CHANGE MANAGEMENT as an enabler to achieve Lean in any service organisation.		Very Low ⟷ Very High				
HCM 1	People's willingness and motivation for change.	1	2	3	4	5
HCM 2	Organisation culture is supportive of lean philosophy (doing right things right first time).	1	2	3	4	5
HCM 3	Treating employees as partners and adopting their valid and effective suggestions.	1	2	3	4	5
HCM 4	Availability of trainings in lean tools, problem identification, basic & advanced tools/ technologies.	1	2	3	4	5
HCM 5	Availability of trainings in interactive /social skills (leadership, communication, customer relationship & soft skills)	1	2	3	4	5
HCM 6	Giving financial and non-financial incentives specifically related to lean contributions and achievements.	1	2	3	4	5
HCM 7	Multi skilled employees who are encouraged to work in cross functional teams.	1	2	3	4	5
HCM 8	Employee feedbacks for ascertaining employee satisfaction in Lean Management	1	2	3	4	5
HCM 9	Empowering employees to take actions/ decisions that facilitate problem identification and solution	1	2	3	4	5

CUSTOMER RELATIONSHIP MANAGEMENT

Kindly rate the degree or level of importance of each initiative related to CUSTOMER RELATIONSHIP MANAGEMENT as an enabler to achieve Lean in any service organisation.		**Very Low ⟷ Very High**				
CRM 1	Services are designed & standardised with VOC in mind.	1	2	3	4	5
CRM 2	Customers' periodic surveys/feedbacks/focus group interviews. (For customer satisfaction, identification and understanding of changing customer needs and expectations) are conducted.	1	2	3	4	5
CRM 3	Extensive customer service program (To reduce customer complaints providing service information & details to the customers, consulting customers on new service & process design, involving customers in social events, responding quickly to complaints).	1	2	3	4	5
CRM 4	Comprehensive database of customers.	1	2	3	4	5

ELIMINATION OF WASTE

Kindly rate the degree or level of importance of each initiative related to ELIMINATION OF WASTE as an enabler to achieve Lean in any service organisation.		**Very Low ↔ Very High**				
EOW 1	Audits or current state analysis to identify value added activities, enhancing the same and reducing non value added activities using value stream mapping.	1	2	3	4	5
EOW 2	Visualisation of process maps and their regular updation.	1	2	3	4	5
EOW 3	Elimination/reduction of 7 wastes (Waiting time, changeover time, Queuing time, Inventory level, unnecessary movements of customers/Work in Process (WIP), process errors etc.) of Lean.	1	2	3	4	5
EOW 4	Defect free services.	1	2	3	4	5
EOW 5	Input (material etc.) is of high level quality.	1	2	3	4	5

CONTINUOUS PROCESS IMPROVEMENT

Kindly rate the degree or level of importance of each initiative related to CONTINUOUS PROCESS IMPROVEMENT as an enabler to achieve Lean in any service organisation.		**Very Low ↔ Very High**				
CPI 1	Periodic meetings to discuss continuous improvement and lean assessment	1	2	3	4	5
CPI 2	Processes are designed to create continuous / uninterrupted flow.	1	2	3	4	5
CPI 3	Clearly defined (purpose & objectives) and standardised processes.	1	2	3	4	5
CPI 4	Metrics such as quality, cost, delivery, customer results & business results for all key processes	1	2	3	4	5
CPI 5	Structured, well defined action plan for problem solving and process improvement.	1	2	3	4	5
CPI 6	Use of continuous improvement tools (5s, visual dashboards, why-why analysis, fish bone diagram etc.)	1	2	3	4	5
CPI 7	Education and influencing customers in order to reduce process variability	1	2	3	4	5
CPI 8	Workload levelling to eliminate overburdening employees /equipment with an aim to match service capacity to customer driven demand	1	2	3	4	5

SUPPLIER MANAGEMENT

Kindly rate the degree or level of importance of each initiative related to SUPPLIER MANAGEMENT as an enabler to achieve Lean in any service organisation.		**Very Low ↔ Very High**				
SPM 1	Suppliers involvement in service process design and development	1	2	3	4	5
SPM 2	Regular training programmes for improvement of suppliers.	1	2	3	4	5
SPM 3	Selection of supplier is based on value addition they bring to company and not only on cost.	1	2	3	4	5
SPM 4	Extensive supplier management programme (for quality audits, free bidirectional flow of information, giving and receiving feedback /suggestions to/from the suppliers.)	1	2	3	4	5

KNOWLEDGE MANAGEMENT

Kindly rate the degree or level of importance of each initiative related to KNOWLEDGE MANAGEMENT as an enabler to achieve Lean in any service organisation.		**Very Low**				**Very High**
KNM 1	Commitment to enhance and expand the knowledge base for lean and promoting it across the organisation using well defined communication strategy and multiple channels.	1	2	3	4	5
KNM 2	Processes for development of new/innovative practices	1	2	3	4	5
KNM 3	Transform tacit individual knowledge into explicit organisational knowledge through cooperation & collaboration	1	2	3	4	5
KNM 4	Capture , review, standardise and share policies, goals , learning and best practices	1	2	3	4	5

INFORMATION AND TECHNOLOGY MANAGEMENT

Kindly rate the degree or level of importance of each initiative related to INFORMATION AND TECHNOLOGY MANAGEMENT as an enabler to achieve Lean in any service organisation.		**Very Low**				**Very High**
ITM 1	Locate and share information based on where & when it will be needed in process to facilitate flow.	1	2	3	4	5
ITM 2	Manage accuracy, timeliness, relevance, quantity and form of information.	1	2	3	4	5
ITM 3	Use reliable & thoroughly tested technology to serve people & processes.	1	2	3	4	5
ITM 4	Enhance technological capability (e.g. computerization, networking of operations, etc.) to increase reliability of services and serve customers more effectively.	1	2	3	4	5

SERVICESCAPES

Kindly rate the degree or level of importance of each initiative related to SERVICESCAPES as an enabler to achieve Lean in any service organisation.		**Very Low**				**Very High**
SVS 1	Comfortable and clean physical environment and ambient conditions like ventilation, noise, lightning, temperature etc. that creates a positive impact on customers and facilitate interactions with them.	1	2	3	4	5
SVS 2	Appealing equipment, physical facilities, signboards, symbols, advertisements boards, pamphlets and other artefacts associated with services to educate and influence customers.	1	2	3	4	5
SVS 3	Physical layout of the premises, facilities and other furnishings to support uninterrupted flow.	1	2	3	4	5
SVS 4	Employees with pleasing and neat appearance for quality assurance.	1	2	3	4	5

OPERATIONAL PERFORMANCE

How do you rate the change in OPERATIONAL PERFORMANCE after the inception of lean practices?		**Very Low**				**Very High**
OP1	Extent to which Level of Wastes (Waiting time, Lead time , Cycle time, Queuing time, Inventory level etc.) have reduced	1	2	3	4	5
OP2	Extent to which Various Costs have reduced	1	2	3	4	5
OP3	Extent to which Resource Utilisation (Productivity, Efficiency) has improved.	1	2	3	4	5
OP4	Extent to which Quality levels have improved.	1	2	3	4	5
OP5	Extent to which Delivery has improved.	1	2	3	4	5
OP6	Extent to which Flexibility has improved.	1	2	3	4	5
OP7	Extent to which Customer Satisfaction has increased	1	2	3	4	5
OP8	Extent to which Innovation has been practised.	1	2	3	4	5

QUESTIONNAIRE (Industry)

PART A: COMPANY PARTICULARS

Name of the Organisation:	
Address	
Website	
Number of employees:	a) 100 or less b) 101- 500 c)501 - 1000 d)1001 – 5000 e) 5001 – 10000 f) More than 10000
Type of Organisation:	Private/ Public Ltd/ Semi Government /Public
Organisation's annual sales turnover (in Crores of Rupees):	a. 0 – 50 b. 51 – 200 c. 201 – 500 d. above 500
Name (optional):	
Designation:	
Phone no / Email Id	
Experience in Years	
Experience in Lean in Years	
Service Sector	a) Banking/ Financial Services b) Healthcare c) IT/ITES d) Telecom

1. Does your organization have adopted/implemented any change initiative/ quality/ process improvement methodology?

   Yes ☐ No ☐

2. If yes, please indicate which one/s:

a. Total Quality Management (TQM) ☐ b. ISO 9000 ☐
c. Lean ☐ d. Six Sigma ☐
e. Lean Six Sigma ☐ f. Other(s) __________________________

3. Number of years since adoption of Lean/change initiative/ quality/ process improvement methodology?

   a. Less than 1 b. 1-3 c. 4-6 d. more than 6

4. Based on your perspective what has been the key objective/s for implementing the above selected initiative? (Can be more than one/ Kindly rank them with rank 1 as the most important)

   a. To enhance operational excellence / operating performance ☐
   b. To improve service quality ☐
   c. To improve customer satisfaction ☐
   d. To improve net income ☐
   e. To reduce cost ☐
   f. To solve chronic/persistent problem ☐
   g. To remain competitive in the global market ☐
   h. To create better image of service ☐

5. Please indicate the trend in annual sales turnover after the inception of Lean/Change Initiative/Process Improvement Methodology
   a. Decrease more than 10% b. Decrease up to10% c. No change
   d. Increase up to 10% e. Increase more than 10%

6. Please indicate the trend in market share after the inception of Lean/Change Initiative/Process Improvement Methodology
   a. Decrease more than 10% b. Decrease up to10% c. No change
   d. Increase up to 10% e. Increase more than 10%

7. Please indicate the trend in profits after the inception of Lean/Change Initiative/Process Improvement Methodology
   a. Decrease more than 10% b. Decrease up to10% c. No change
   d. Increase up to 10% e. Increase more than 10%

8. Please indicate the trend in customer base after the inception of Lean/Change Initiative/Process Improvement Methodology
   a. Decrease more than 10% b. Decrease up to10% c. No change
   d. Increase up to 10% e. Increase more than 10%

9. Which of the following Lean tools/practices are being used in your organisation?

a. 5s		b. Visual Management	
c. Pareto Analysis		d. Value Stream Mapping	
e. Waste Reduction		f. Cross functional teams	
g. One piece flow		g. Kaizen Workshop	
h. Standardisation		h. Cause & Effect Analysis	

10. Have your organisation received any certification in quality/productivity/ customer satisfaction? If yes please mention the certification, agency and the year in which it was awarded.

	Certification	Agency	Year
Quality			
Productivity			
Customer Satisfaction			
Others			

11. Is there anything else that has not been covered above that you wish to tell us about change initiative/ strategy/ quality/ process improvement implemented in your organisation?

PART B

Follow survey questionnaire for validity and reliability of proposed initiatives and practices for achieving Lean in services. Kindly fill the questionnaire as per your expertise and knowledge related to Lean practices being implemented by you in service organisation.
The item scales are on five-point Likert scales with:
1 = very low, 2 = low, 3=medium, 4= high, 5=very high

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Kindly rate the degree or level of importance of each initiative related to ELIMINATION OF WASTE as an enabler to achieve Lean in any service organisation.		**Very Low ↔ Very High**				
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Kindly rate the degree or level of importance of each initiative related to CONTINUOUS PROCESS IMPROVEMENT as an enabler to achieve Lean in any service organisation.		**Very Low ↔ Very High**				
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INFORMATION AND TECHNOLOGY MANAGEMENT

Kindly rate the degree or level of importance of each initiative related to INFORMATION AND TECHNOLOGY MANAGEMENT as an enabler to achieve Lean in any service organisation.		**Very Low ↔ Very High**				
ITM 1	Locate and share information based on where & when it will be needed in process to facilitate flow.	1	2	3	4	5
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SERVICESCAPES

Kindly rate the degree or level of importance of each initiative related to SERVICESCAPES as an enabler to achieve Lean in any service organisation.		**Very Low ↔ Very High**				
SVS 1	Comfortable and clean physical environment and ambient conditions like ventilation, noise, lightning, temperature etc. that creates a positive impact on customers and facilitate interactions with them.	1	2	3	4	5
SVS 2	Appealing equipment, physical facilities, signboards, symbols, advertisements boards, pamphlets and other artefacts associated with services to educate and influence customers.	1	2	3	4	5
SVS 3	Physical layout of the premises, facilities and other furnishings to support uninterrupted flow.	1	2	3	4	5
SVS 4	Employees with pleasing and neat appearance for quality assurance.	1	2	3	4	5

OPERATIONAL PERFORMANCE

How do you rate the change in OPERATIONAL PERFORMANCE after the inception of lean practices?		**Very Low ↔ Very High**				
OP1	Extent to which Level of Wastes (Waiting time, Lead time , Cycle time, Queuing time, Inventory level etc.) have reduced	1	2	3	4	5
OP2	Extent to which Various Costs have reduced	1	2	3	4	5
OP3	Extent to which Resource Utilisation (Productivity, Efficiency) has improved.	1	2	3	4	5
OP4	Extent to which Quality levels have improved.	1	2	3	4	5
OP5	Extent to which Delivery has improved.	1	2	3	4	5
OP6	Extent to which Flexibility has improved.	1	2	3	4	5
OP7	Extent to which Customer Satisfaction has increased	1	2	3	4	5
OP8	Extent to which Innovation has been practised.	1	2	3	4	5

LIST OF SERVICE ORGANISATION

Name of the Organisation	Location
3i InfoTech	Mumbai
Aditya Jyot Eye Hospital Pvt. Ltd.	Mumbai
Arisglobal Software Company	Bengaluru
Computer Sciences Corporation	Hyderabad
Home Credit India	Gurugram
[24] 7	Bengaluru
ABN Amro Asia Corporate Finance (I) Pvt Ltd	New Delhi
ABN Amro Bank	Multilocation
Accenture	Multilocation
Accenture Enterprise Enablement	Pune
Accenture Management Consulting	Gurugram
Accenture Services Pvt Ltd	Bengaluru
Access Health International	Hyderabad
Accurate Data Convertors Pvt Ltd	Coimbatore
Acropetal Technologies Limited	Bengaluru
ADAAP Process Solutions Pvt. Ltd.	Bengaluru
Add Value Consulting	Ahmadabad
Aditi Technologies	Bengaluru
Aditya Birla Financial Services Group	Mumbai
Aditya Birla Hospital	Pune
Aditya Group Of Hospitals	Kolkata
Adobe	Noida
ADP Private Limited	Multilocation
Aegis Limited	Multilocation
Affinity Express	Pune
AGC Networks	Mumbai
Agile For Growth	Pune
AIG	Multilocations
Aircel Business Solutions	New Delhi
Ajel Technologies	Hyderabad
Alcatel-Lucent	Multilocations
Allianz Bajaj Life Insurance Co Ltd	Pune
Allianz Global Assistance India	Pune
Allianz Insurance	Thiruvananthapuram
Allsec Technologies Ltd	Chennai
Amdocs Development Centre India Private Limited	Pune
American Express	Multiple Location
American Express India Pvt. Ltd.	New Delhi
American International Group Inc	Mumbai
Ameriprise Financial Services, Inc.	New Delhi
AMP Technologies	Chennai
AMRI Hospitals, Bhubaneswar	Bhubaneswar

Name of the Organisation	**Location**
Ananthapuri Hospitals And Research Institute	Thiruvananthapuram
Annik Technology Services	Gurugram
ANZ	Bengaluru
Aon	Bengaluru
Aon Hewitt	Noida
Apex Business Solution	Ahmedabad
Apex Heart Institute	Ahmedabad
APMG International (India)	Bengaluru
Apollo Gleneagles Hospitals, Kolkata	Kolkata
Apollo Group Of Hospitals/ Clinics	Multilocations
Apollo Health And Lifestyle Limited	Chennai
Apollo Munich Health Insurance Company Ltd.	Multilocations
Apptad Technologies Pvt Ltd	Bengaluru
APTECH LTD	Mumbai
Aravind Eye Care Sytem	Madurai
Arbitron Technology Services India (P) Ltd	Kochi
Arcgate	Rajasthan
Aricent Group	Gurugram
Artemis Hospitals	Gurugram
Arvato India	Mumbai
Arvato Services	Mumbai
Asian Heart Institute And Research Center Pvt Ltd	Mumbai
Asian Institute Of Medical Sciences	Delhi
Aster Aadhar Hospital	Kohlapur
Aster MIMS	Kozhikode
Astron Healthcare	Ahemdabad
Astron Hopsital & Healthcare Consultants	Multilocations
AT&T	New Delhi
Atos	Bengaluru
Atos Worldline	Mumbai
Authbridge Research Services	New Delhi
Avantha Business Solutions	Gurugram
Avaya	Pune
Aviva	Bengaluru
AXA Business Services Pvt. Ltd	Multiloactions
AXA Technologies Shared Services	Bengaluru
Axcend Automation & Software Solutions Pvt Ltd	Bangalore
Axis Bank	Mumbai
Axon Network Solutions Private Ltd	Bangalore
Axsys Technologies Ltd	Kolkata
BA Continuum India Pvt Ltd	Gurgram
Baehal Software Ltd	Bangalore
Bahwan Cybertek Inc	Chennai
Bajaj Capital Limited	New Delhi
Bajaj Finserv	Pune
Bank Of America	Gurugram

Name of the Organisation	Location
Bank Of America Merrill Lynch	Chennai
Bank Of New York - Mellon	Pune
BAPS Pramukhswami Hospital	Gujrat
Barclays	Noida
Barclays Bank PLC	Mumbai
Barclays Investment Bank	Chennai
Barclays Shared Services	Chennai
Barclays Technology Centre,	Pune
Barry-Wehmiller International	Multilocations
Bayer Business Services	Mumbai
Best Of Breed Software Solutions India Pvt Ltd	Bangalore
Bharat Financial Inclusion Limited	Multilocations
Bharti Airtel Limited	Multilocations
Bharti AXA General Insurance	Bengaluru
Bharti Foundation	Gurugram
Bharti Infratel Limited	Gurugram
Bharti Learning Systems Limited	Gurugram
Bharti Teletech Limited	Gurugram
Birla Global Finance Ltd	Mumbai
Birla Sun Life Insurance	Multilocation
Birlasoft (India) Ltd	Noida
Bitsinbin Technologies Pvt Ltd.	New Delhi
BLK Super Speciality Hospital	Multilocation
BMC Software India Pvt Ltd	Pune
BMGI	Mumbai
BNP Paribas	Mumbai
BNP Paribas India Solutions Private Limited	Chennai
BNP Paribas Securities Services	Mumbai
BNY Mellon	Pune
BOP Group	New Delhi
British Telecom	Gurugram
British Telecom Professional Services	Gurugram
Broadridge Financial Solutions (I) Pvt Ltd	Multilocations
BT Global Services	Pune
BTI Payments Pvt. Limited.	Bengaluru
Business Excellence Institute Pvt Ltd	Bangalore
Cades Digitech Pvt Ltd	Bangalore
Capgemini Consulting Pvt. Ltd	Multilocations
Capgemini FS GBU	Mumbai
Capita	Mumbai
Capita IT Services	Pune
Capital Float	Bengaluru
Captronic Systems Pvt Ltd	Bangalore
Care Hospital	Hyderabad
CARE Hospitals Group	Multilocations
CARE Hospitals, Quality CARE India Limited	Hyderabad

Name of the Organisation	**Location**
Cbay Systems (I) Pvt. Ltd.	Mumbai
Cerulean Information Technology Pvt Ltd	Bangalore
CGI	Bengaluru
Chaitanya Hospital	Chandigarh
CIG Solutions	Hyderabad
Cigna TTK Health Insurance Company Limited	Multilocation
Cigniti Technologies	Hyderabad
Citi	Mumbai
Citibank India	Gurugram
Citicorp Services India Ltd, Mumbai	Mumbai
Citrix Systems	Bengaluru
CK Birla Hospitals	Kolkatta
Clear2Pay	Noida
Cloudnine Hospitals	Multilocations
Clover Technologies Pvt Ltd	Mumbai
CMC Ltd	Multilocation
CMS Info Systems	Mumbai
CNO Financial Group	Hyderabad
Cnonymn Mobitech Pvt. Ltd	Hyderabad
CNSI	Chennai
Cogent E Services Pvt LTD	Noida
Cognizant Business Consulting	Mumbai
Cognizant Technology Solutions	Multilocations
Columbia Asia Hospitals Pvt Ltd	Multilocations
Concentrix	Bengaluru
Concentrix / IBM	Kolkatta
Congruent Solutions Pvt Ltd	Chennai
Continental Hospitals	Hyderabad
Continental Hospitals Limited,	Hyderabad
Convergys India Services	Bengaluru
Convergys SEA	Gurugram
Corbus, LLC	Noida
Cosmonet Solutions	Bengaluru
Covansys	Bengaluru
Cranes Software International Ltd	Bengaluru
Credit Suisse	Multilocation
CSC	Noida
CSS Corp	Multilocations
CSS Technergy Ltd	Hyderabad
Cubic Computing Pvt. Ltd.	Bengaluru
Cybage Software	Pune
Cybizcall (International) Pvt Ltd	Gurgaon
Cygnus Hospital	New Delhi
Cygnus Medicare Pvt. Ltd.	Delhi
Cyient Limited	Multilocations
D&B Transunion Analytic & Decision Services Pvt Ltd	Chennai

Name of the Organisation	Location
Damco Solutions Pvt Ltd	Multilocations
Dataflow Group	New Delhi
Datamatics Global Services Ltd.	Mumbai
DBOI Global Services	New Delhi
DDF Healthcare Consultants	New Delhi
Dell International Service Pvt Ltd (BPO)	Chennai
Deloitte	Multilocations
Deutsche Bank	Multilocations
Dextrasys Technologies Pvt Ltd	Trichy
Dhanush Infotech Pvt Ltd.	Hyderabad
Dharamshila Hospital & Research Centre	New Delhi
DHFL Pramerica Life Insurance	Gurugram
Dr. L. H. Hiranandani Hospital	Mumbai
Dr Lal Pathlabs	Multilocations
Dr. Balabhai Nanavati Hospital	Mumbai
Dr. Prem Hospital	New Delhi
Dr.Agarwal's Eye Hospital	Madurai
DSP Merrill Lynch Ltd	Mumbai
E - Virtual Services	Noida
E4e Business Solutions India Pvt Ltd	Bangalore
Eaton Technologies Pvt Ltd	Pune
Eclerx	Pune
Edelweiss Capital	Mumbai
Edelweiss Tokio Life Insurance	
Effective Medtech	New Delhi
Einfochips	Ahmedabad
EMC India	Gurugram
Emerio	Pune
EMQ Technologies	Kolkatta
Encore Capital Group	Gurugram
Epam Systems	Hyderabad
Epicenter Technologies	Mumbai
Ericssion	Gurugram
Erstwhile Viom Networks	Gurugram
ESI Group	Bengaluru
Espire Infolabs	Gurugram
Etean	Thiruvananthapuram
Etihad Etisalat Co. (Mobily)	Bengaluru
Evalueserve	Bengaluru
Evolutionary Systems Pvt Ltd	Ahmedabad
Exa Infotech Pvt Ltd	Gurugram
EXL Services	Pune
Experian	Mumbai
Export-Import Bank Of India	Mumbai
Factset	Hyderabad
Father Muller Medical College Hospital	Manglore

Name of the Organisation	Location
Fidelity Investments	Bengaluru
Finnatel Technologies	Chennai
First American Financial Corporation	Hyderabad
First Ring India Pvt Ltd	Bangalore
Firstsource Solutions Limited	Multilocations
FIS	Gurugram
Fiserv	Multilocations
FNF Business Process Outsourcing Services India Pvt Ltd	Bangalore
Fortis Healthcare	Multilocations
Fortis Hospital	New Delhi
Franklin Templeton Investments	Hyderabad
Fujitsu India	Gurugram
Fusion Technologies	Hyderabad
Galaxe.Solutions	Noida
GE Capital	
GE Capital (SBI Cards)	New Delhi
GE Capital Business Process Management Services Ltd.	Gurugram
GE Money Servicing	Hyderabad
GE Money Servicing	Hyderabad
Gebbs Healthcare Solutions	Mumbai
GEN Works	Bengaluru
GENPACT	Multilocations
Genpact Headstrong Capital Markets	Noida
Geometric Ltd.	Pune
Ginni Investment & Services Ltd	Kolkata
Global Analytics	Chennai
Global Finance Transformation Director	Bengaluru
Global Health City,	Chennai
GLOBAL HOSPITAL,	MUMBAI
Global Logic	Noida
Globalnest It Solutions (P) Ltd	Kolkata
Grid Infocom	Gurugram
Group Of MGM Hospital	Mumbai
Groupon	Chennai
Haworth Solutions Private Limited	Noida
HCG Hospitals, Cuttack & Ranchi	Multilocations
HCL BPO	Multilocations
HCL Infosystems Ltd	Noida
HCL Technologies	Multilocations
HDB Financial Services Ltd.	New Delhi
HDFC Bank	Multilocations
HDFC Life	Mumbai
HDFC Life Insurance Co. Ltd	Multilocations
HDFC Standard Life Insurance	Mumbai
HEXAWARE TECHNOLOGIES LTD	Navi Mumbai
HGSL	Bengaluru

Name of the Organisation	Location
Hinduja Global Solutions	Multilocations
HINDUJA HEALTH CARE LTD	Mumbai
Hinduja Hospital	Mumbai
Hitachi Consulting	Hyderabad
Hitachi Solutions India Pvt Ltd	Hyderabad
Hospital Quality Consultant	Chennai
HSBC Bank	Multilocation
HSBC Data Processing India (P) Ltd,	Visakhapatnam
HSBC EDPI Pvt Ltd	Bengaluru
HSBC Electronic Data Processing	Gurugram
HSBC Electronic Data Processing (Guangdong) Limited	
HSBC Financial Services	Hyderabad
HSBC Global Banking And Markets	Bengaluru
HSBC Global Finance Centre	Multilocation
HSBC Global Resourcing	Kolkata
HSBC Global Service Centre	Chennai
HSBC Technology	Multilocations
HTC Global Services	Hyderabad
Huawei Technologies	Bengaluru
Hughes Systique Corporation (HSC)	Gurugram
Hurix System Pvt Ltd	Mumbai
IBM Daksh	Gurugram
IBM India Private Limited	Multilocation
IBS SOFTWARE SERVICES PVT LTD	Thiruvananthapuram
ICICI Bank	Multilocation
ICICI Lombard	Mumbai
ICICI Prudential Life Insurance Company Limited	Mumbai
Icreon Communications Pvt. Ltd.	Noida
IDBI Capital Market Services Ltd	Mumbai
Idea Cellular Ltd	Multilocation
Ienergizer	Noida
IGATE Global Solutions Ltd	Pune
Ignis Technology Solutions Pvt Ltd	Bangalore
IIPM	New Delhi
Inautix Technologies Indian Pvt Ltd	Multilocation
Independent Trainer And Consultants	Mumbai
Indotronix International Corporation	Hyderabad
Indus Integrated Information Management LTD	Kolkata
Indusind Bank	Mumbai
Infogain India Pvt Ltd	Noida
Infosys	Multilocation
Infosys BPO	Multilocation
ING Vysya Bank	Multilocation
Innodata Inc.	Noida
Intelenet Global Service	Multilocation
INTELIMENT SOFTWARE TECHNOLOGIES (I) PVT LTD	Pune

Name of the Organisation	Location
Interglobe Technologies	Gurugram
Inube Software Solutions Pvt Limited	Bengaluru
IQ City Narayana Multispecialty Hospitals	West Bengal
IRIS Hospital	Multilocation
Iris Software Inc.	Noida
Ison BPO	Multilocations
ITC Infotech India Ltd	Bangalore
Iyogi	Gurugram
J.R.Laddha Financial Services Pvt Ltd	Mumbai
Jabalpur Hospital & Research Centre (Association With Fortis	Jabalpur
Jaslok Hospital & Research Centre	Mumbai
Jaypee Hospital	Noida
Jehangir Hospital	Pune
Jindal Intellicom Limited	New Delhi
JLL	Gurugram
John Keells BPO Solutions	Gurugram
K7 Computing Private Limited	Chennai
Karvy Computershare (P) Limited	Hyderabad
Keane India Limited	Multilocation
KEM Hospital	Pune
KIMS Super Speciality Hospital	Hyderabad
Kokilaben Dhirubhai Ambani Hospital & Medical Research	Mumbai
Kotak Mahindra Bank	Multilocations
KPIT Cummins Infosystems Ltd	Pune
KPIT Technologies	Pune
KPMG Global Services Pvt Ltd	Bengaluru
L&T Finance Limited	Mumbai
L&T Infotech	Multilocation
Lead To Market	Bengaluru
LG CNS Co., Ltd.	Bengaluru
Liberty Videocon General Insurance	Mumbai
Liradolf Information Technologies & Engineering Services Pvt.	Bengaluru
Lisie Hospital	Cochin
Logic ERP Solutions Pvt Ltd	Mohali
Lourdes Hospital, Kochi	
LSI Financial Services Pvt Ltd	Kolkata
Maersk Global Service Centers (India) Pvt. Ltd.	Pune
Magma Fincorp Ltd.	Kolkatta
Magma Housing Finance(Formerly GE Money Housing Finance)	Kolkatta
Magna Infotech	Chennai
Maharaja Agrasen Hospital	New Delhi
Mahindra & Mahindra Financial	Mumbai
Mahindra Comviva	Gurugram
Mahindra Finance	MUMBAI
Mahindra Satyam	Multilocations
Mallya Hospital	Bengaluru

Name of the Organisation	Location
Manipal Health Enterprises Pvt, Ltd	Multilocations
Manipal Hospital	Multilocation
Manorama Hospitex	Patna
Maple Software Pvt Ltd	Visakhapatnam
Mashreq Bank	Mumbai
Mastek Ltd	Mumbai
Mastercard	Bengaluru
Max Bupa	New Delhi
Max Healthcare	Multilocations
Max Institute Of Health Education And Research (MIHER)	Noida
Max Life Insurance Co. Ltd	Multilocations
Max Super Speciality Hospital	Multilocations
Maxivision Super Speciality Eye Hospital	Chennai
Medanta - The Medicity Hospital	New Delhi
Medica Superspeciality Hospital	Kolkatta
Mediconnect Infomatics	Pune
Medpoint Healthcare Group	Multlocations
Medreach	Chennai
Mepas Innovation	Bengaluru
Merrill Corporation, India	Chennai
Metalogic Systems Pvt Ltd	Kolkata
Metlife Global Operations Support Center Private Limited	Noida
Metlife Insurance	Noida
Microland Limited	Bengaluru
Micromax Informatics Ltd.	Gurugram
Microsoft	Hyderabad
Mindssoft Technology	Madurai
Mindtree	Bengaluru
Misys	Bengaluru
Mobily Infotech India Pvt Ltd	Bengaluru
Moolchand Hospital	New Delhi
Morpho	Noida
Motilal Oswal Financial Services Ltd	Mumbai
Mphasis	Mumbai
Msys Tech India Pvt. Ltd.	Multilocation
MTS - Sistema Shyam Teleservices Ltd	Gurugram
Muthoot Finance Ltd	Multlocations
NABH Assessor -QCI	Mumbai
Narayana Multispecialty Hospital,	Multilocation
National Heart Institute	New Delhi
National Payments Corporation Of India	Mumbai
National Stock Exchange Of India Limited	Mumbai
NEC Technologies India Ltd.	Multilocation
Neilsoft Ltd	Pune
Netapp India	Mumbai
Netmagic Solutions (An NTT Communications Company)	Mumbai

Name of the Organisation	**Location**
Network Systems & Technologies (P) Ltd	Trivandrum
Nihilent Technologies	Pune
NIIT Technologies Limited	Multilocations
Noble Institute Of Quality Certification - NIQC	Bengaluru
Nomura	Mumbai
Northern Trust Corporation	Bengaluru
Nova Specialty Hospitals	Multiocation
NTT DATA	Gurugram
NTT DATA Global Delivery Services Pvt Ltd	Chennai
Nucleus Software	Noida
Nxtradata Ltd.	Gurugram
Octavo Solutions Pvt Ltd	New Delhi
Ocwen Financial Corporation	Bengaluru
Omega Healthcare Management Services Private Limited	Bengaluru
Omniism	Ahmedabad
Optimum Solutions	Bengaluru
Optum Global Solutions (Unitedhealth Group)	Multilocation
Oracle	Multlocations
Oracle Financial Services Software Ltd	Multilocation
Ortho One - Orthopaedic Speciality Centre	Coimbatore
Oxigen Services India Pvt Ltd	Multilocation
Paradigm Management Solutions	Mumbai
Paras Healthcare Pvt Ltd	Gurugram
Paras HMRI Hospital	Patna
Patni Computer Systems	Pune
PCS Technology	Mumbai
Peerless Hospital & B. K. Roy Research Centre	Kolkatta
Persistent Systems	Pue
PNB Metlife India Insurance Co. Ltd.	New Delhi
Polaris Consulting & Services Ltd	Chennai
Polaris Financial Technology Limited	Multilocations
Portea	Bengaluru
Preeminent Technology India Pvt.LTD	Hyderabad
Principal Financial Group	Pune
Principal Global Services	Pune
Professional Access	Mumbai
Prometheus Group, Inc.	Chennai
PSI Data System	Bengaluru
Pushpagiri Eye Hospital	Hyderabad
QA Infotech, Noida	Noida
Qimpro Consultants Pvt. Ltd.	Mumbai
Q-Input	Jaipur
QRG Health Care	Faridabad
Q's Corner	Chennai
Qualcomm India Pvt Ltd	New Delhi
Quality Imorovement Consultants	Multilocations

Name of the Organisation	Location
Quantum Business Consulting Pvt Ltd	Kolkata
Quantum Solutions	Chandigarh
Quantumq Technologies	Bengaluru
Quatrro Business Support Services Private Limited	Gurugram
Quatrro Global Services	Gurugram
Quest Diagnostics	Gurugram
Quest Informatics Pvt Ltd	Bangalore
Quintiles	Bengaluru
Rajagiri Hospital	Cochin
Rajiv Gandhi Cancer Institute & Research Centre	New Delhi
RAMCO SYSTEMS LTD	Chennai
RBS Business Services Pvt Ltd	Chennai
Reliance	
Reliance Insurance	Mumbai
Reliance BPO Private Limited	Mumbai
Reliance Capital , Commercial Finance Division	Mumbai
Reliance Capital Limited Group Of Companies	Mumbai
Reliance Commercial Finance	Mumbai
Reliance Communications	Multilocation
Reliance General Insurance	Mumbai
Reliance Home Finance Ltd.	Mumbai
Reliance Jio Infocomm Limited	Mumbai
Reliance Life Insurance	Multilocation
Reliance Money	Mumbai
Religare Enterprises Ltd	New Delhi
Rishabh Software Pvt Ltd	Vadodara
Rockland Hospital	New Delhi
Royal Bank Of Scotland	Multilocations
RSM Astute Consultech Pvt Ltd	Surat
Rsystems	Noida
Ruby Hall Clinic	Pune
S.R.Trust - Meenakshi Mission Hospital And Research Centre	Madurai
Safran Identity & Security	Noida
SAFRAN Morpho	Noida
Sahyadri Speciality Hospital	Pune
Sahai Hospital & Research Centre	Jaipur
Sakra World Hospital	Bengaluru
Samudra Software Ltd	Visakhapatnam
Santokba Durlabhji Memorial Hospital,	Jaipur
Sapient Consulting Limited	Gurugram
Sapient Global Markets	Gurugram
Sasken Technologies Limited	Bengaluru
SCA TECHNOLOGIES INDIA PVT LTD	Gurgaon
SDG Corporation: IT Security And Risk Management Solutions	Noida
SDG Software India Pvt Ltd	Noida
Serco BPO	Multilocations

Name of the Organisation	Location
Sevenhills Healthcare Private Limite	Mumbai
SEVENSTAR HOSPITAL	Nagpur
SHALOM INFOTECH PVT LTD	Trichy
Sierra Atlantic	Hyderabad
SIFY TECHNOLOGIES LTD	Chennai
SIGMA INFOSOLUTIONS LTD	Bengaluru
Sistema Shyam Teleservices Ltd	
Sitel	Mumbai
SKS Microfinance Limited	Hyderabad
SLK Global	Bengaluru
Sobis Software (India) Pvt Ltd	Bengaluru
Société Générale	Bengaluru
Societe Generale Global Solution Centre Bengaluru	
Sofgen India Pvt Ltd	Chennai
Softtech Engineers Pvt Ltd	Pune
Softtek	Bengaluru
Software Paradigms (India) Pvt Ltd	Mysore
Softwareone India Pvt Ltd	Gurugram
Solutionsiq India Consulting Services Pvt. Ltd.	Bengaluru
Sonata Software Ltd	Bangalore
Sopra Steria	Multilocations
Spanco BPO	Mumbai
Sparsh Hospital;	Bangalore
Srijan Technologies	Multilocation
Srishti Software Pvt Ltd	Bangalore
SS&C Globeop	Multilocations
St Martha's Hospital	Bengaluru
Standard Chartered Bank	Multilocations
Standard Chartered Bank, Scope International	Multilocations
Standard Chartered Global Business Services	Multilocation
State Street HCL Services	Multilocations
Steria (India) Ltd	Noida
Sterling Hospital	Ahmedabad
Sterlite Technologies Ltd.	Pune
Sundaram Infotech Solutions Limited	Chennai
Sungard Solutions (I) Pvt Ltd	Bangalore
Sunlife Financial	Gurugram
Suntec Business Solutions	Thiruvananthapuram,
Suntech Business Solutions Pvt Ltd	Trivandrum
Sutherland Global Services	Hyderabad
Sutherland Healthcare Solutions	Hyderabad
Symantec	Pune
Symphony Services Corp	Pune
Symphony Teleca	Bengaluru
Synchrony Financial	Hyderabad
Synergia Consultants Pvt Ltd	Bangalore

Name of the Organisation	Location
Synowledge LLC (Information Technology And Services)	Bengaluru
Syntel	Pune
Systech Software	Bengaluru
Tanla Solutions Ltd	Hyderabad
Target	Bengaluru
Tata AIA Life Insurance	Multilocation
Tata Business Excellence Group	Mumbai
Tata Business Support Services Limited	Hyderabad
Tata Capital	Multilocation
Tata Communications Ltd	Multilocations
Tata Consultancy Services	Multiple Locations
Tata Consultancy Services BPS	Multilocations
Tata Docmo	New Delhi
Tata Interactive Systems	Mumbai
Tata Medical Center	Kolkatta
Tata Motors Finance	Mumbai
Tata Technologies Ltd	Pune
Tata Teleservices Ltd	Multilocation
Tavant Technologies	Noida
TCS BFS BPO	Chennai
TCS E-Serve International Ltd.	Mumbai
Teleperformance India	Gurugram
Temenos	Chennai
Tesco Hindustan Service Centre (Hsc)	Bangalore
The Muthoot Group	Multilocations
The World Bank	Chennai
Thomson Reuters	Hyderabad
Tieto	Pune
Topsys Solutions Pvt. Ltd.	Bengaluru
Trans Warranty Finance Ltd	Mumbai
Transunion	Mumbai
Trigyn Technologies Ltd	Mumbai
Trizetto	Pune
TVS Infotech Ltd	Chennai
UBS	Hyderabad
Unisoft Infotech Pvt Ltd	Bengaluru
Unison Insurance Broking Services Pvt Ltd	Mumbai
Unisys	Bengaluru
United Health Group (ITES)	Multlocations
Unity Care And Health Services Pvt Ltd	Mangalore
UST Global	Chennai
Vadamalayan Hospitals	Madurai
Valtech India Systems Pvt Ltd	Bangalore
Valueadded Corporate Services (P) Ltd,	Hyderabad
Vasan Healthcare Private Ltd	Multilocations
Vastek Solutions Pvt Ltd	Trichy

Name of the Organisation	**Location**
Vayam Technologies Ltd.	Noida
Vee Technologies Pvt Ltd	Bangalore
Verity Knowledge Solutions Pvt. Ltd. (UBS Investment Bank)	Hyderabad
Vertex	Jaipur
Verve Communications Pvt Ltd	Pune
V.G.M. Hospital	Coimbatore
Vfsl Capital Ltd	Mumbai
Vidyatech Solutions Pvt Ltd	Noida
Vikas Global Solutions Ltd	Bangalore
Virmati Software & Telecommunications Ltd	Ahmedabad
Vision Managements	Jaipur
Vodafone Essar Digilink Ltd	Jaipur
Vodafone Essar Limited	Mumbai
Vodafone India	Multiple Locations
Vodafone Mobile Services Ltd, Delhi	Pune
Vodafone Shared Services India	Pune
Volvo IT	Bengaluru
Vsoft Technologies Pvt. Ltd.	Hyderabad
Wipro	Pune
Wipro BPS	Bengaluru
Wipro Consulting	Multilocations
Wipro Infotech	Gurugram
Wipro Technologies	Bengaluru
WNS Global Services	Multilocations
WNS Global Services	Multilocations
Wockhardt Hospitals	Multilocations
Xavient Information Systems	Noida
Xavient Software Solutions (I) Pvt Ltd	Noida
Xchanging	Multilocations
Xebia Group B.V.	Gurugram
XL Group PLC	Gurugram
XL Health Corporation India Pvt. Ltd. -	Bengaluru
Xlhealth Insurance	Bengaluru
Xsysys Technologies Pvt Ltd	Bangalore
YASH Technologies	Multilocation
Yashoda Hospitals	Hyderabad
Yashoda Super Speciality Hospitals	Ghaziabad
Yes Bank	Multilocations
Zafin	Thiruvananthapuram
Zenith Infotech Ltd	Mumbai
Zensar Technologies	Pune
Zenta Knowledge Services	Chennai
ZS Associates	New Delhi
Freelancer	Gurgaon, Haryana
AAD Management Consultants Ltd.	Gurugram
ABC Transformation Corp	Mumbai

Name of the Organisation	**Location**
Academy Of Hospital Administration [Institute Of Healthcare	Noida
ACCESS Health International	Hyderabad
ACE Vision Health Consultants Pvt. Ltd.	Jaipur
ACME Consultancy In Management Education	Pune
Acme Consulting	Chennai
Add Value Consulting Inc	Ahemdabad
Agile For Growth	Pune
Agile Lean Business Solutions (ALBS)	Bengaluru
Anabasis Consultants	Gurugram
Arunoday Consultatnts	Greater Noida
Axa Business Services	Pune
Benchmark Six Sigma	New Delhi
Bizzofit Consultancy	New Delhi
Boon Management Consultants Pvt. Ltd.	Mumbai
Breakthrough Consultancy Services	New Delhi
Brickwork Rating (Healthcare Quality)	Banglore
Concept Business Excellence Pvt. Ltd	Vadodara
Consultant And Trainer	New Delhi
Creative Solutions	Bengaluru
Ctrlx Global Services Pvt. Ltd	Multilocations
Cvmark Consulting	Banglore
D K Somaiya & Associates - Lean Consultants	Bengaluru
Data Management Consultants	Chennai
DDF Healthcare Consultants	New Delhi
EFESO Consulting	Gurugram
Enrich IT Solutions Pvt Ltd	Chennai
Ernst & Young	Gurgaon , India
Fanatic Academy Of Quality	Indore
Fgnc Consulting	Mubai
First Choice Healthcare Consultancy	Indore, MP
Freelance Trainer And Consultant	Pune
Freelance Trainer And Consultant	Banglore
Freelancer	Kanchipuram, Tamil Nadu,
Freelancer	Mumbai
Freelancer Safe/Agile/Lean Trainer & Consultant	Gurugram
Freelancer Trainer And Consultant (Majumdar)	Mumbai
H+ Consulting	Mumbai
Haworth6Sigma Quality Solutions	Atta Market, Noida
Hawthorn 6Sigma Quality Solutions	
Healthcare Quality And Patient Safety Consultant	Mumbai
Here Quality Excellence Pvt. Ltd.	Vadodara
Hospaccx Healthcare Business Consultancy Pvt. Ltd	Mumbai
HOSPITECH HEALTHCARE CONSULTANCY	Banglore
HSQS	New Delhi
IIM Khozikode	Khozikode
Imet Global Ltd	Noida

Name of the Organisation	Location
Independent Consultant	Mysore
Independent Consultant (Kallakuri)	Hyderabad
Independent Consultant (Quality And Business Excellence Mentor)	New Delhi
Independent Consultant (Various)	New Delhi
Independent Health Consultanat	Bhopal
Indian School Of Professional Excellence (ISPE)	Chennai
Institute & Consultancy	Banglore
Institute Of Applied Quality Management	Kolkatta
Institute Of Quality , CII	New Delhi
Institute Of Sigma Learning	Hyderabad
Integra-Ventures - Streamlining Healthcare	Multilocations
Intellect Design Arena Ltd	Chennai
International Trainers' Federation	Noida
ISO International Organization For Standardization	Banglore
IVBL	Mumbai
Izenbridge Consultancy Private Limited	Gurugram
Jishuken Center Of Excellence	New Delhi
JP Morgan	Mumbai
Juran Academy India Pvt Ltd	Chennai
Kaizen Enablers Academy	Bengaluru
Kaizen Institute	Multilocation
KINDUZ Business Consulting, LSS Consulting Firm	Mumbai
Knowledgehut	Banglore
Leading Consultant Gurus And Training Organizations	Banglore
Lean For U	New Delhi
Lean Healthcare Initiativesand Lean Process Labs	Bengaluru
Lean Horizons Consulting	New Delhi
LEAN INDIA Conulting Group	New Delhi
Lean Management Institute Of India	Bengaluru
Lean Mantra	Bengaluru
Lean Sigma Consultants	Gurugram
Lean Sigma Six	Gurugram
Lean Six Sigma Academy	New Delhi
Lean Transformation Consultancy Pvt. Ltd	Bengaluru
Leanpitch Technologies Private Limited	Bengaluru
Lifeskills Consultants Pvt Ltd	New Delhi
Logic Flick	Greater Noida
Manipal University Jaipur	Jaipur
Margdarshan Management & Measurement Pvt. Ltd	Gurugram
Mastro Lee	Coimbatore
Mckinsey & Company	Gurugram
Mediconnect Infomatics	Pune
Medix Consultancy Services	Mumbai
Mercuri Orion Consultancy Services	Mumbai
Mevocon	Banglore
Morpheus Archetypes Management Solutions Pvt. Ltd.	Pune

Name of the Organisation	**Location**
MQAS Pvt. Ltd.	Noida
MSME DI, GOI.	Chennai, Banglore
Multiple Consultancy	New Delhi
Nagarro	Gurugram
National Health Mission	Lucknow
National Health System Resource Centre	Dhanbad
National Institute Of Industrial Engineering (NITIE)	Mumbai
National Productivity Council	Banglore
Nethradhama Superspeciality Eye Hospital	Bengaluru
Next Space	Banglore
Nextgen	Banglore
NGP Institute Of Technology	Coimbatore
OCHRE Studies Group	Pune
Octavo Solutions Pvt Ltd	New Delhi
Operational Excellence Management Consultants	Bengaluru
Paradigm Shift Educon	Pune
Parix	New Delhi
PDCA Consultants	Noida
Perception Management Consulting Pvt. Ltd.	Gurugram
PM Expert Services Pvt Ltd	New Delhi
PRISM Trainings And Consultancy	New Delhi
Pwc India	New Delhi
QA & Six Sigma	Hyderabad
QC Services	Pune
QHSE And Lean Professional- Faciltator, Counsellor, Auditor ,	Chandigarh
Qimpro Consultants	Pune
Q-Input	Jaipur
Quality Consultant	Hyderabad
Quality Council Of India	Newdelhi
Quality Solutions	Noida
Quality Thara Solutions	Puduchery
Qualitygurukul Management Consultants Pvt. Ltd.	New Delhi
Qvision Consultancy	Chennai
RBIT	Bengaluru
Redmad Learnings	Vadodara
RNTBCI	Tamil Naidu
S S Narayanan&Associates	Coimbatore,
Sakun Lean Consultants	Pune
Satven	Chennai
SERCO	Ghaziabad
Seven Steps Business Transformation Systems	Bengaluru
Sidekickedge Management Consulting Services	New Delhi
Siemens Healthcare	Mumbai
Sigmaguru	Pune
Simpler Consulting	New Delhi
Six Sigma Process Solution	Chennai

Name of the Organisation	**Location**
Solutions	Pune
Solutions Kaizen Management Systems	Mumbai
Spark	Pune
SSA Business Solutions (P) Ltd	Mumbai
State Street	Bengaluru
SWA	Mumbai
The CPI Coach (Continuous Permanent Improvement)	Mumbai
The School Of Continuous Improvement, Accredited By Council	Mumbai, India
Thought At Work™	Pune
TQM International Pvt. Ltd.	New Delhi
Trignos Inc	Bengaluru
Tuvsud Southasia	Banglore
UG Consultancy (Diversified Healthcare Services)	Mumbai
Vedzen Institute	Pune
Vigorous Quality Management System Pvt Ltd	New Delhi
Vinay Baijal Consulting	Banglore
Vision Raval	Ahemdabad
WCO Consultants Pvt Ltd	Chennai
Xebia IT Architects Pvt Ltd	Gurugram
TQM International Pvt. Ltd.	New Delhi
Trignos Inc	Bengaluru

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BIOGRAPHY

Shradha Gupta is currently pursuing her PhD as a Research Scholar in Department of Management Studies at Malaviya National Institute of Technology (MNIT), Jaipur, Rajasthan (State), India. She has done Masters in Management Studies (Honours) in Systems and has obtained her degree in Bachelor of Engineering (Honours) in Civil also from the same institute Malaviya Regional Engineering College, Jaipur Rajasthan University. She has actively participated and organised in number of International and National Conferences and workshops. She has also published numerous papers in reputed journals and conferences.

She has four years of experience with corporate and three years of experience in academia. She is currently also a member of AIMS International (Association of Indian Management Scholars).