1. INTRODUCTION

Lean and SixSigma are two systematic business process methods followed by organizations to successfully achieve increased value to customer by eliminating waste, variation and defects in organizational processes, products and services while saving time and cost without capital investment. While both methods aim at transformation of organizational processes, their underlying assumptions and approaches are different. Lean methodology aims to eliminate waste and maximize the customer value. SixSigma methodology aims to eliminate defects in the business process and maximize the quality, resulting in increased customer value. Therefore, both, Lean and SixSigma together are proven methodologies that increase efficiency, effectiveness, quality resulting in continuous improvement to increase the customer value.

This chapter presents the motivation to propose integration of Lean methodology and SixSigma in the Information Technology Services paradigm. This chapter identifies the research contributions and also outlines the organization of this thesis.

1.1. MOTIVATION

1.1.1. LEAN METHODOLOGY

The presence of waste in an organization makes the processes slow and inefficient. Lean is a process control methodology that continuously focuses on the elimination of waste, smooth process flow and reduction of cycle times resulting in optimum customer satisfaction. The core concepts of this methodology are:

- The process must not deliver anything which is not of value to the customer.
- The process must not deliver anything until it is needed by the customer.
- The process must improve the quality by optimizing flow and reducing waste and cost.

Lean evolved primarily in the automobile industries of Japan and U.S.A. Although, some of the earliest examples of employing the underlying pillars of Lean can be traced back to the 16th century, Lean was originally developed by Toyota as an assembly-line manufacturing methodology known as the Toyota Production System. Implementing Lean production enabled
Toyota to minimize inventory, maximize the use of multi-skilled employees, flatten the management structure, focus resources where they were needed and deliver on demand. Toyota also focused on reducing system response time to quickly change and adapt to market demands. This move resulted in their made-to-order automobiles. Toyota finally succeeded in producing top quality cars at low prices through Lean principles.

The current model for Lean Manufacturing was developed and refined by Toyota in the 1940s, 50s and 60s. Lean became a universal phenomenon when in 1990; Womack, Jones, and Roos (2007) published the book “The machine that changed the world”, which introduced the term Lean to describe the set of attributes that embodied the Toyota Production System. During the 1980s, Lean methodology was adopted by many manufacturing companies across U.S. and Europe. For example, Dell Computers and Boeing Aircraft have embraced the philosophy of Lean production with great success. Today, Lean or at least some of its most popular concepts are used in all types of industries including the non-manufacturing companies. The history of Lean has come a long way. Lean can be summarized as "to get the right things to the right place at the right time, the first time, while minimizing waste and being open to change".

1.1.2. SIXSIGMA METHODOLOGY

Defects are defined as unacceptable deviation from the mean or target. SixSigma is a well-structured data-driven methodology to manage the process variations that cause defects and eliminate these defects. The objective of SixSigma is to deliver high performance, reliability and value to the end customer. The main concepts of this methodology are:

- Continuous efforts to achieve stable results by reducing process variations.
- Process performance must be measured, analyzed, improved and controlled.
- Achieve sustained performance and quality improvement.

SixSigma has also evolved over time. This methodology was pioneered by Bill Smith at Motorola in 1986. It was initiated as a statistically based method to reduce variation in electronic manufacturing process in Motorola. SixSigma helped Motorola achieve powerful results at reduced cost. Since then, hundreds of companies around the world, with an aim to reduce cost
and improve quality have adopted SixSigma. Texas Instruments, Scientific-Atlanta and Allied Signal are a few of the companies that practice SixSigma.

The philosophy behind SixSigma is that if you measure the number of defects that are in a process, you can find a method to systematically eliminate them and get as close to perfection as possible. To achieve SixSigma, the defects per million opportunities cannot be more than 3.4 where an opportunity is defined as a chance for nonconformance.

1.1.3. NEED FOR INTEGRATION OF LEAN AND SIXSIGMA

How is Lean different from SixSigma?

Lean implementation in a company enables to minimize inventory, maximize the use of multi-skilled employees, flatten the management structure, focus resources on where they are needed and deliver on demand, while SixSigma implementation is about precision and accuracy leading to data-driven decisions. Thus, SixSigma will eliminate defects but it will not address the question of how to optimize process flow. Lean is about speed, efficiency and never ending cycle of continuous waste removal while SixSigma focuses on cost, quality and schedule.

Why Lean SixSigma?

Although Lean and SixSigma are different business management strategies to achieve business excellence, both these strategies need to be combined as having one without the other results in process destruction. The combination of both the methods brings the best of both worlds.

Lean SixSigma combines process improvement with quality improvement. While Lean implements rapid business process, the problem of errors in the process is reduced by using SixSigma. Lean and SixSigma together, promise to address all types of process problems with the most appropriate toolkit. Lean SixSigma delivers faster results by establishing baseline performance levels and focusing the use of statistical tools, where they will have the most impact. Lean SixSigma combines the strategy and solution sets inherent in Lean with the cultural, organizational process and analytical tools of SixSigma. It is a methodology that, when
properly implemented, ensures organizational effectiveness and efficiency. Usually, for companies using Lean SixSigma, the first step is to apply basic Lean-manufacturing techniques and eliminate waste.

What are the implementation roles?

A significant organization-wide culture shift has to be rolled out to achieve bottom-line strategic business results by implementing Lean SixSigma. The range and sustenance for any service improvements will be limited where it is essential to develop an environment which is process focused than task focused. To appreciate a customer centric service organization and make it thrive, “delivery of right service at the right time” must be the main motto while training the organization members. Service industries must aim in providing their members with diligent training programs on Lean SixSigma to help them realize the potential of this framework and understand the available tools and methodologies which can yield service improvements which are long term.

Key business values achieved by Lean SixSigma

- Helps in the speedy delivery of quality products and services at reduced cost resulting in high customer satisfaction – a key ingredient to achieve improved performance and sustain competitive advantage in businesses.
- Cultivates innovation and places more emphasis on continuous process improvement.
- Identifies key drivers of economic profit and shareholder value to create project portfolio.
- Develops broad cultural change and creates a common operational language.
- Builds long lasting organizational capability to create and sustain a process-performance advantage.
- Eliminating waste not only reduces costs but also results in rapid business and more response to customers, increasing the revenue growth.

Thus, SixSigma and Lean complement each other to provide the best operating performance possible. Operating excellence is a key global driver of economic profit with analysis revealing
that 30-80% of the costs in a service business are pure waste. Never ending elimination of waste and high-quality driven business processes through the integration of the proven improvement methodologies Lean (Speed) and SixSigma (Quality), organizations can address strategic priorities and transform operations.

1.1.4. IMPORTANCE OF LEAN SIXSIGMA IN SERVICE ORGANIZATIONS

Although both SixSigma and Lean have their roots in manufacturing, today every sector including the service industries have embraced Lean SixSigma to improve performance and profits. Lean SixSigma can be applied to service just as effectively as manufacturing as both businesses attract cost, encounter delays/lead time, existence of errors/variations and so on. These challenges are universal and not unique to manufacturing as they all impact the customer. In today’s dynamic world, service organizations must commit to provide a complete, effective and rapid service to maintain competitiveness in the global market. The Lean SixSigma approach can be effectively applied to meet this challenge. Deployment of Lean SixSigma in service organization makes it more responsive and customer oriented.

All the developed and developing economies in the world are services based and these organizations are researching on achieving process improvements using Lean SixSigma. The significant and long standing effects of blending SixSigma and Lean are understood by service organizations and initiatives are in progress to achieve high quality and efficiency in the processes.

*Lean SixSigma benefits to Service Organizations*

Rendering best Customer Service is the main objective of any service organization. Lean SixSigma methodology enables this objective to be achieved successfully. Embracing this methodology enables the organization to better identify and meet the customer needs by emphasizing creative problem solving and teamwork. It also focuses on continuous improvements where performance is constantly evaluated, re-tooled as needed and enhances the overall financial health of the organization. Lean SixSigma provides a service-based approach, explaining how companies of all types can cost-effectively translate manufacturing-oriented
Lean SixSigma tools into the service delivery process. George (2003) an expert in SixSigma, reveals how easy it is to apply relatively simple statistical and Lean tools that will reduce costs and achieve greater speed in service processes.

To summarize, any service organization by embracing Lean SixSigma can:

- Reduce waste and costs
- Improve communications
- Improve service and experience
- Achieve greater customer satisfaction

**Lean SixSigma in Service Organization**

Unlike manufacturing operations, applying Lean SixSigma in a service organization is challenging. Service organizations have different root causes for their problems as they follow different set of processes and metrics when compared to manufacturing. Manufacturing problems are within a process, but the service problems are often the process itself. In a service organization, the efficiency of the flow of information and its quality are critical as these parameters enable effective interactions and communications among people within the organization and them interfacing with the customers. Changing the process of these flows within the organization and making them lean by removing the wastes will yield best quality of services rendered to the customers. The heart of every service business is the opinions, behaviors and decisions made by people. Analyzing and modifying this human performance in service environments is complex but Lean SixSigma provides appropriate framework and processes to make it simple for implementation and achieve significant long-term improvements.

Lean SixSigma integrates principles of business, statistics and engineering to achieve measurable results across the entire value chain. It concentrates on cross-functional, cooperative problem solving, systems thinking, quality management and continuous improvement. Lean SixSigma can be applied across every discipline including: Design, Production, Sales, Service, Finance, Marketing and Administration. Lean SixSigma project in any organization aims to achieve cost
saving, reducing process cycle times of the processes to enable on time delivery of services. Lean SixSigma also helps a service organization to become a customer focused.

Lean improves the speed of fulfilling customer requirement by eliminating wastes in the process in the supply chain while SixSigma’s statistical methods to realize, quantify and lessen process variation improves the consistency of service performance and service quality.

Service organizations have transformed Lean SixSigma tools used in manufacturing into the service delivery process. It is important to create a comprehensive implementation plan so that organizations can establish measures and processes to control and sustain the Lean SixSigma improvements aligning to the business strategies. Needless to mention that it is essential to document the project artifacts so that this historic data of procedures, results, post mortem data of the projects successes and areas of improvements to help upcoming projects within the organization and also pass on to customers and other organizations and researchers. Lean SixSigma projects will reduce the company's service costs, improve service delivery time and expand capacity.

1.2. RESEARCH QUESTIONS

While organizations are under intense pressure, operational excellence is the key to success of organizations as while focusing on business growth, it is essential to have a tab on erosion of operating margins. Operational efficiencies are being the foremost parameter for continuously improving the organizational efficiencies in the competitive market scenarios and varying factors of economy. This intense pressure puts organizations in a situation for achieving efficiency through realizing more with fewer resources. Lean SixSigma teams help executives explore and address a variety of business questions. The present research addresses the following research questions that the thesis explores in the next chapters.

- How to integrate Lean and SixSigma methodologies in an Information Technology services context?
- How can this integrated Lean SixSigma be applied to Information Technology services and service-based processes for continuous improvement?
- How does implementation of Lean Six Sigma contribute to financial performance?
1.3. **THESIS ORGANIZATION**

This thesis comprises seven chapters. The first chapter is an introductory part which includes the motivation, general introduction about Lean and SixSigma followed by need for an integration of these two methodologies and importance of Lean SixSigma in IT Services. The introductory chapter also describes the research questions. Following this, the next chapter provides an insight into the Literature Review of IT service industry, software quality, broad overview, role, development and significance of Lean and SixSigma methodologies in service industries. Related literature on agile methodologies with a focus on SCRUM and Lean SixSigma in a flexibility paradigm which is relevant to the current research is also surveyed. Significance of these methodologies in service industries has been supported by successful stories. The third chapter discusses this thesis’s research design and methodology adopted in the current study. A case study research methodology is adopted for the present study and the fourth and fifth chapters deal with two empirical cases that are undertaken in this research. The research analysis and findings, summary of these findings are dealt in the sixth chapter. The thesis is concluded through a discussion on the research undertaken in the last chapter.