EXECUTIVE SUMMARY

In today’s global business environments and economy, software industry has emerged as one of the most strategic industry. Software applications and systems are the driving force behind current business operations. But the software development has been a complex and troublesome process. Software projects have the highest probability of being delayed or cancelled. Researchers observed three critical issues that contribute to software project failures. They include inaccurate estimation, inaccurate status reporting, and inadequate quality control. Adding to this, senior executives also contribute to software problems. They reject accurate estimates, apply harmful schedule pressure that is impossible, and add new requirements during development work. This indicates that in software development projects software professionals are most of the time dealing with the technical aspects and the management aspect of software development process is ignored to a largest extent.

But, in today’s marketplace, the rapid globalization of software industry with constant technological advances, the competition is getting more intense. Customers are demanding higher quality, lower cost, and shorter lead-time for software services and products. In this situation the traditional approach and mindset to software development are not enough. Most effective and efficient processes are needed.

A careful analysis of top manufacturing companies with successful track records revealed that, by using Lean Sigma, they discovered opportunities, and produced breakthrough innovations that had profound impacts on their business processes. Therefore, scientists, researchers and process experts believe that Lean Sigma can bring similar benefits to software organizations by uncovering process wastes, reducing non-value-added activities, and increasing efficiency and effectiveness of the software development processes. Furthermore, few software companies have already started experimenting on Lean Sigma approach for software development process. But it is in its early stages.

Lean Sigma is a combination Lean and Six Sigma approaches – two of the most popular management practices to enhance competitiveness in the manufacturing industry. But, unlike manufacturing, software development is very different as it is not producing any physical products. Instead, it is creating an intellectual property, which is highly dependent on the developers’ creativity. Moreover, software
development process has more uncertainties and complexities than manufacturing process. Therefore, the main objective of this research is to explore the opportunities and challenges in implementing Lean Sigma to improve software development process. This will help in collective understanding on the effectiveness of Lean Sigma approach to improve software development activities. The result will ultimately benefit the software industry as a whole, which is one of the most dynamic and vibrant sectors in India’s economy contributing significantly to the country’s Gross Domestic Product (GDP).

In order to achieve the research objectives, exploratory and descriptive research designs have been chosen as the researcher intends to extend the applicability of a theory from the manufacturing process to a new context – software development process and the implementation of Lean Sigma to improve software development process is in its nascent stage. This research work is based on a questionnaire survey addressed to software professionals who are involved with software process improvement. The respondents are from leading service and product oriented software companies in India (Bangalore, Chennai, and Hyderabad) and their strategic business partners abroad (Singapore, Canada, the USA, and UK).

Snowball sampling technique was adopted for selection of respondents as it is very difficult to identify software professionals with a blend of project management experience, knowledge on different maturity models, agile, Lean and Six Sigma, and had an opportunity to work on such strategically important projects. In snowball sampling respondents were selected based on the referrals. The collected data was analyzed utilizing descriptive statistics, one-sample t-test, independent samples t-test, chi-square test, and contingency table analysis.

From the sample it was found that 23.5% of respondents are senior executives, 31.6% of them are project managers, 27.5% of the professionals are project/team leaders, and 17.3% of them are software engineers. Majority of the respondents have more than 10 to 15 years of experience in handling software development projects and various process improvement initiatives like, CMM, Lean and Six Sigma to improve software development process. This indicates that the respondents had very good knowledge on the software development process and various process improvement initiatives.
The present study indicated that majority of the respondents from service and product oriented software companies expressed more than 50% of opportunities in implementing Lean Sigma to improve the capability of software development process. These opportunities include prioritizing requirements to quickly deliver value to the customer, visualization of workflow to understand the sources of errors, elimination of non-value-added activities, producing right thing the first time, adopting quantitative software project management approach, improving the process based on the fact, and defining value stream for the software development process.

Unlike manufacturing, the very nature of software development process is intangible and is not repeatable. The higher degrees of process invisibility, requirement volatility, task uncertainty, and architectural ambiguity in the software development activities pose many challenges to the implementation of Lean Sigma to software projects. It was observed that the majority of professionals expressed challenges in setting up visual flow, identifying non-value-added activities, identifying bottlenecks and wait time to work items, setting financial benefits, and designing Lean Sigma framework to software development process. However, the advantages of implementing Lean Sigma to software development processes are equally great.

Furthermore, the study indicated that majority of the respondents expressed more than 50% advantages with respect to setting high priority requirements to deliver value to the customer, getting visibility into all work items, reducing re-work, improvement in cycle time and lead time, improvement in quality and productivity, and customer satisfaction. It was also found that the knowledge level of Lean and Six Sigma in the software community is very significant, and the software professionals have favorable attitude towards adopting Lean Sigma to improve software development process.

Finally, a conceptual model – Design for Improved Yield and Accuracy (DIYA) was proposed for the implementation of Lean Sigma to the software development process. More than two-third of the respondents from service and product segments were in the agreement that the proposed Lean Sigma model is promising for the software development process and can bring changes incrementally to better process for improved quality and productivity. There is no doubt that the applications of Lean Sigma for software development process grow rapidly in coming years.