



Model based design of robust framework implementation for process improvement in IT companies.

Sajid Ahmed Ghanghro^{1,*}, Muhammad Ajmal Sawand², Noriaki Yoshiura³, Abdullah Soomro⁴, Ubaidullah Alias Kashif⁵, Kishor Kumar⁶

^{1,3}Department of Information and Computer Science, Saitama University, Japan

¹Department of Computer Science, Shah Abdul Latif University, Khairpur, Pakistan

^{2,6}Department of Computer Science, Sukkur IBA University, Pakistan

⁴Department of Computer Science, The Islamia University of Bahawalpur, Pakistan

⁵Department of Computer Science, The Shaikh Ayaz University Shikapur, Pakistan

ahmed.s.285@ms.saitama-u.ac.jp, sajid.ghanghro@salu.edu.pk, ajmal.sawand@iba-suk.edu.pk, yoshiura@fmx.ics.saitama-u.ac.jp, abdullah.soomro@iub.edu.pk, kashif.ubaidullah@gmail.com, kishor.mscs19@iba-suk.edu.pk

Abstract: This has been always a problem faced by Software Manufacturers to deliver an application before time with satisfactory quality, high performance and productivity. Due to this problem, the time for development gets shortened and organizations focus more on quality of the product, resulting in more pressure on the development team. Organizations focus on rapid productivity rather than focusing on standard productivity. These problems lead many projects on referent point. In Pakistan, 85% IT companies face many difficulties and challenges to improve their processes due to numerous reasons. The purpose of this research is to identify these problems and difficulties so that these challenges may be addressed. This research is the survey-based analysis of Process Improvement Challenges, which are faced by small and “medium size IT companies in Pakistan”.

Keywords: Process Improvement; Quality; Productivity; Challenges; Solution;

I. INTRODUCTION (HEADING 1)

Process Improvement plays an important role to achieve strategic and business goals of an organization. In today's technological world, it is necessary to adopt the best practices and processes to compete the needs of the organization. Such organizations have to start from low levels and constantly invest in process improvements to gain higher levels. Small and medium size IT companies faces many difficulties in process improvement activities, so also in its different areas. Process Improvement is a continuous process to enhance the processes followed in an organization to increase its service and product quality, reduction in development cost, to meet the deadlines and to gain the customer satisfaction. In Pakistan, government bodies like Pakistan Software Export Board (PSEB) are also promoting process improvement activities in local software and IT industry but many small and medium sizes IT companies are facing many challenges in process improvement activities.

They are facing many problems in different areas of process improvement as well. Most of the organizations did not get the required results form process improvement activities. In Pakistan mostly software houses and IT companies are with small sized teams and found it disturbing to dedicate effort and resources to process improvements[1].

This research identified these challenging areas of process improvements. Such identified areas are Process

Improvement Objectives and Measurement, Budget and Time Management, Risk Management, Training and HR Management and finally Documentation area of process improvement. This research paper would majorly focus on the CMMI (capability maturity model Integration), challenges in putting into practice of CMMI model in Pakistan IT industry[2], and moreover it would be concluding and highlighting the importance of this model in the betterment of Pakistani Software Industry. Process is the step by step procedure to accomplish a specific task and process improvement is the continuous effort of refinement of processes followed in the organization to get strategic objectives and goals of the organization [3, 4].

Process Improvement enhances the quality of the product, reduces manufacturing cost, making possible to accomplish the project in a given time and to meet scope of the project[4]. It also enhances the satisfaction of the customer. In Pakistan many IT companies are operating and providing different IT related services to customers. They are also trying to improve their existing processes/models so that they can meet the customer's requirements in addition to get the trade objectives and goals. In the process of process improvement activities they face many difficulties[5]. This research focuses on the challenges faced by “small and medium size IT companies in Pakistan”.

II. AIM OF RESEARCH PAPER

Process Improvement plays an important role to achieve strategic and business goals of an organization. In today's technological world, it is necessary to adopt the best practices and processes to compete the needs of the organization. Small and medium size IT companies faces many difficulties in process improvement. This research aims to identify these challenges and difficulties behind process improvement. This research is the survey based analysis of Process Improvement Challenges faced by "small and medium size IT companies in Pakistan". Process Improvement: Process Improvement plays an important role to achieve strategic and business goals of an organization[6]. In today's technological world, it is necessary to adopt the best practices and processes to compete the needs. Small and medium size IT companies faces many difficulties in process improvement. This research focuses to identify these challenges and difficulties behind them. The title of the research study includes.

III. BACKGROUND AND OVERVIEW

Many research papers have already been published by IEEE, ACM and software engineering journals about process improvement in Pakistan. There are many models used in Pakistan for process improvement[5]. Many IT companies are trying to implement CMMI process so that they can compete in the market and customers may satisfy form their quality products. Based on previous work done by researchers, we decided to access the current state of process enhancement in "small and medium size IT companies in Pakistan"[7]. We choose the small and medium size IT companies of Pakistan and gathered the information of major process improvement areas including "Process Improvement Objectives and Measurement", "Budget and Time Management", "Risk Management", "Training and HR Management", and "Documentation". Review of the literature in this article focuses mainly on the facts and information gathered from other articles published in the SEI, IEEE and ACM, webinars conducted by the SEI and conversations with process improvement experts in the field of process improvement[8]. "This literature review work was conducted using information gathered from two webinars and about 30-40 papers. Once the documents are found, the following parameters are used to hand-picked the research article literature".

A. Reliability

Papers from IEEE and ACM databases are reliable. However, in case of process improvement, SEI is most reliable source because SEI is the governing body that manages and monitors process improvement all over the world[9]. The articles that were cited are also mainly approved by SEI experts.

B. Timeline

Software process improvement is rapidly growing area when compared with other fields. But many companies are failed to achieve their objectives form process improvement activities and faced many challenges to implement it in their organizations[10]. The research articles that are referred, contains most unconventional research evidence on the discussed topic.

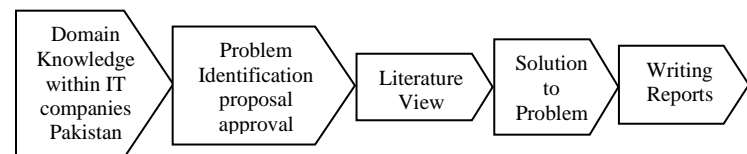
C. Reputation

The research articles used in literature are also refereed on the basis of their contained contains. Most of the papers accessible in this study are quoted many times by trustworthy authors[9]. Authors of most of the papers are well known seasoned and experience process improvement experts.

IV. METHODOLOGY

The limits that are measured for selecting the methods for this study are time, cost, and reliability. Literature study review, as it is collected from trustworthy sources, ascertained to be much trustworthy although some of them are costly like SEI membership and IEEE articles[10]. Major time portion was spent on the collection of sources, and it had been effective method. We had to conduct interviews and discussions with process experts that were a time-consuming task. However, interviews and discussions helped me a lot to discover the root cause of problems. The Methodology includes:

- Domain Knowledge, it includes within IT companies in Pakistan
- Problem Identification
- Literature View: Collected data will be analyzed and will be presented graphically
- Solution to Problem
- Writing Report



A. Interviews and discussion

This paper does not rely only on literature view but the problem was also discussed with the process improvement experts to find the root cause. Interviews and discussions were conducted with experts for the same to get their opinion[11]. I visited many process improvement persons. Their answers were reliable and helpful because they have practical experience of different organizations and faced problems.

B. Literature data

After the analysis of the available data it is revealed that the root cause of issues of process improvement

activities faced by “small and medium size IT companies in Pakistan” are “Process Improvement Objectives and Measurement”[12], “Budget and Time Management”, “Risk Management”, “Training and HR Management” and “Documentation”. So, these process areas of are used to develop questionnaire.

1. *Documentation*

The purpose of documentation is to enhance the efficiency of work and keep record of all the information when needed. It also helps to improve process improvement activities. It also provides the evidence of any work product or process under consideration[13]. A well-documented policy of any organization reveals the maturity of their processes they followed

2. *Budget and Time management*

The purpose of this area is to judge the maturity level of time and budget management. In this section Return on Investment (ROI) related information is accessed and analyzed accordingly[14].

3. *Risk Management*

The persistence of Risk Management (RSKM) is to recognize possible complications before they arise so that risk-handling activities can be scheduled and invoked as desired across the life of the product or project to diminish opposing influences on accomplishing intents.

4. *Process Improvement Objectives and Measurement*

The purpose of Process Improvement Objectives and Measurement is to access the knowledge of process improvement objectives set by organization and how effectively they are managing and measuring the milestones established[15]. Either they have any measurements regarding output of process improvement activities or not.

C. *Results*

This section concludes the results collected from literature and analysis review are represented in the form of graphs for easy understanding. The questionnaire was sent to number of companies from which 50 sent back the filled questionnaire. All the organizations are IT related. Based on available data percentage was calculated. This percentage depicts the implementation of any process improvement activities and based on calculated

percentage, results are derived, process area wise and overall maturity level wise as well as shown below.

1. *Overall implement the Process Improvement challenges faced in different process areas*

The following result shows that only 29.36% process improvement activities are fully implemented in “small and medium size IT companies in Pakistan”[16].

It also shows that there are 35.5% processes which are not at all or rarely followed in IT companies and 35.92% processes are followed often.

Table 1. Process Improvement

	Percentage			
	Not At All	Rarely	Often	Always
Documentation	6.57	19.72	35.92	37.79
Budget and Time Management	13.79	21.84	36.21	28.16
Risk Management	9.05	41.81	27.59	21.55
Training and HR Management	8.01	33.97	36.22	21.79
Process Improvement Objectives and Measurement	10.91	21.83	36.73	30.53
Overall Process Improvement	9.44	25.96	35.24	29.36

Graphical representation of above table.

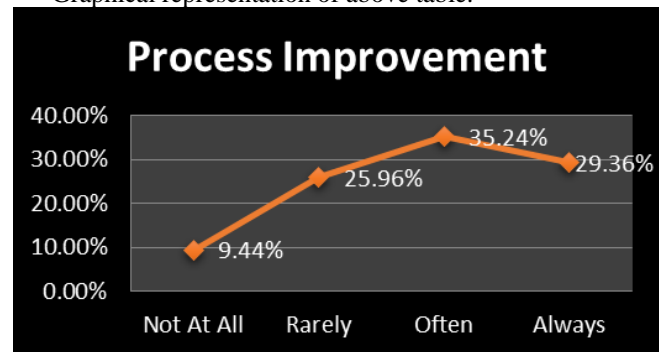


Figure 1. Process improvement analysis result

2. *Implement the Process Improvement Challenges in “Documentation” area*

The following result shows that only 37.79% process improvement achieved in “documentation area”[17]. It also shows that there are 26.29% processes improvement is not followed or rarely followed in IT companies and 35.92% processes are followed often[18].

Table II. Documentation survey result

	Percentage			
	Not At All	Rarely	Often	Always
Documentation	6.57	19.72	35.92	37.79

Graphical representation of above table

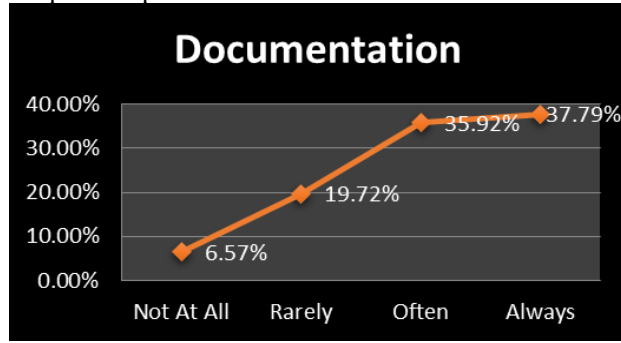


Figure 2. Documentation analysis result

3. *Implement the Process Improvement Challenges in “Budget and Time Management” area.*

The following result shows that only 28.16% process improvement achieved in “budget and time management area”[19]. It also shows that there are 35.63% processes improvement is not followed or rarely followed in IT companies and 36.21% processes are followed often.

Table III. Budget and Time management survey result

	Percentage			
	Not At All	Rarely	Often	Always
Budget and Time Management	13.79	21.84	36.21	28.16

Graphical representation of above table

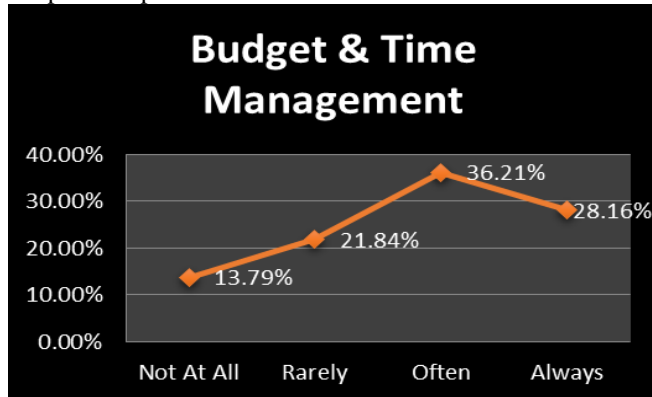


Figure 3. Budget and time analysis result

4. *Implement the Process Improvement Challenges in “Risk Management” area*

The following result shows that only 21.55% process improvement achieved in “risk management area”[20]. It also shows that there are 50.86% processes improvement is not followed or rarely followed in IT companies and 27.59% processes are followed often.

Table IV. Risk management survey result

	Percentage			
	Not At All	Rarely	Often	Always
Risk Management	9.05	41.81	27.59	21.55

Graphical representation of above table.



Figure 4. Risk management analysis result

5. *Implement the Process Improvement Challenges in “Training and HR Management” area*

The following result shows that only 21.79% process improvement achieved in “training and HR management area”. It also shows that there are 41.98% processes improvement is not followed or rarely followed in IT companies and 36.22% processes are followed often.

Table V. Training and HR Management Survey Result

	Percentage			
	Not At All	Rarely	Often	Always
Training and HR Management	8.01	33.97	36.22	21.79

Graphical representation of above table



Figure 5. Training and HR management analysis result

6. *Implement the Process Improvement Challenges in “Objectives and Measurement” area*

The following result shows that only 30.53% process improvement achieved in “process improvement objectives and measurement area”[16]. It also shows that there are 32.74% processes improvement is not followed or rarely followed in IT companies and 36.73% processes are followed often.

Table VI. Objective and Measurement survey result

	Percentage			
	Not At All	Rarely	Often	Always
Process Improvement Objectives	10.91	21.83	36.73	30.53

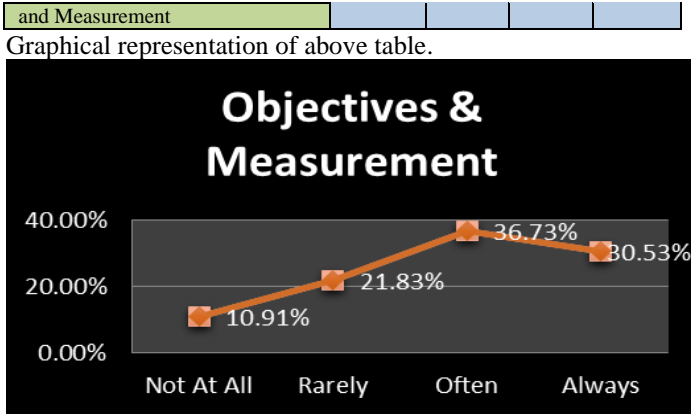


Figure 6. Objective and measurement analysis result

After study the literature view and analysis the above problems in implementation of CMMI in Pakistan IT industry[21], I found a solution a by merger lean development model in Scrum methodology, First we need to know the Scrum methodology and lean Software Development.

V. SCRUM MODEL

Scrum is a frame work that manages the software Development. And is an agile process that focuses on delivering the product in a shorterperiod. Scrum is project management framework used to manage the project efficiently. In Scrum framework, the product is developed iteratively called Sprints. Each Sprint typically consists of 2-4 weeks long. And consist of 5-9 team members and the activities performed in the sprint are Requirement gathering, designing, development, and testing. The team does not consist of traditional Software Engineering roles like a developer, designer, and tester[22]. So in the scrum framework, there is no such dependency of phases over another because there different stages of development are performed parallel. And the scrum master is responsible for managing the team is working and make sure of the product delivery on time.

The Scrum mainly consists of

- a. Product Owner
- b. Scrum Master
- c. Team

A. Product Owner

Product owner closely participate in the product development because Product owner defines features of the product, decide release date, prioritize the features allowing for marketing worth and accepting or discarding the results[23].

B. Scrum Master

Represents overall management of the project, removes hurdles, remove ambiguities, and make sure that the team is fully functional and also participate and coordinate during the sprint.

C. Scrum Team

Mainly consists of 5-9 peoples typically; the team must be cross functional like it must include Developer, Tester, Designer, etc. Teams are self-organized, and the member can be changed after completion of the sprint.

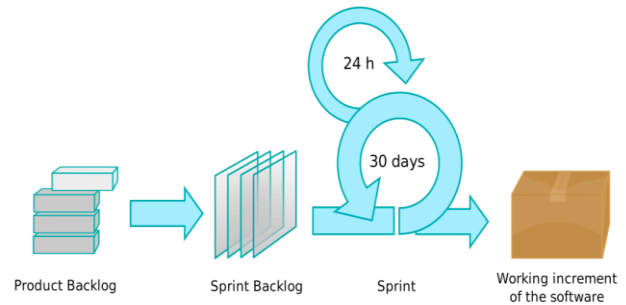


Figure 7. Scrum Model Representation

VI. LEAN MODEL

A Lean Model is a kind of software development approach, which emphasizes, in general, to optimize efficiency and to minimize waste at all levels while developing any sort of software. Sometimes, Lean thinking is mingled with the general concepts of agile thinking only because of putting more effectiveness in applying efficiencies and managing waste while developing such software, nevertheless, in context of development of software, both development practices contain shared characteristics[24]. One of the basic principles of a lean model is to focus on regular communication with the customers in delivering such software as soon as possible, so also gaining continuous improvement in its all parts, which is known as customer focused approach. It encapsulates the concepts of an early software testing and an iterative approach to software development. Lean model focuses on the above-mentioned factors.

- Eliminate waste
- Amplify learning
- Decide as late as possible
- Deliver as fast as possible
- Empower the team
- See the whole

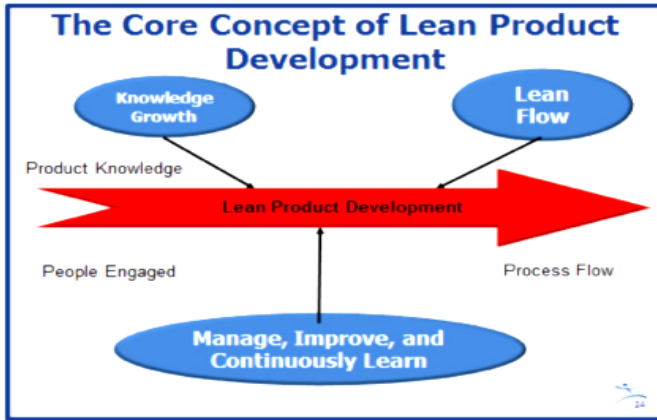


Figure 8. Lean Model Representation

VII. SOLUTION

After literature view and observed problem, I proposed a new model that is scrum + lean model, that model covers the above issue that reflect in improvement the process

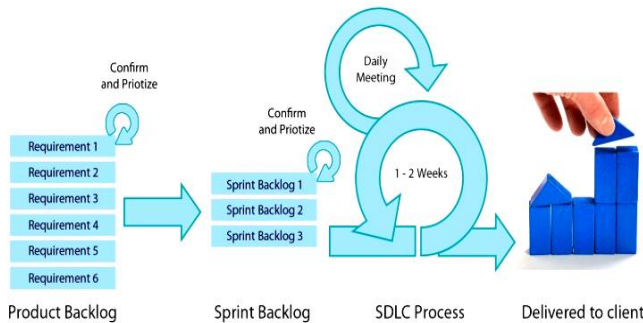


Figure 9. Proposed Model

A. Product Backlog

It is a single important artifact, essence, and detailed analysis requirement of the system, all the functional and Non-functional requirement are defined, in simple it is called To-dos list, this is the initial and effective phase of the model.

B. Priortized Product Backlog

Once we create the product backlog, that backlog need to prioritized, it is very essential to prioritize the product backlog, it help organization to develop system in a smooth

C. Sprints

Sprints start with a sprint planning meeting that meeting might take 3 to 4 hours, this meeting is held by product owner and team to negotiate the stories and requirement from product backlog and create a sprint, sprint is a shippable product, no matter what sprint is

deliver, Product owner take decision about the priority of the user stories that which should the 1st sprint and so on.

D. Sprint Iteration

Sprint iteration is a time Box, in which development team takes place, the duration time is 1 to 2 week, so that it would be deliverable to client[14], in sprint iteration include meeting on daily basis at morning that what we achieved and what to do today.

E. Deliverable

It is a small shipment to client to draw his/her attention toward the project, as he knows that organization is working on his product.

VIII. ADVANTAGES OF THIS MODEL

Following are the advantages of this model,

1. **Improved Customer service:** The main goal for IT industry is to improve its customer service, when we talk about the agile development and lean model, than we draw customer attention towards his/her product, Organization ensure that we are working on their product/software.
2. **Fast delivery:** When we work in the lean model, it is easier to deliver a quality product in a scheduled time. it is an iterative model on completing every sprint we deliver that sprint to the client, in this era it is not the biggest that survives[25] , but the fastest, the sooner you deliver the product to customer without major defect, the sooner to receive the customer feedback.
3. **Enhance team Motivation:** In organization when a team has to work on new technology then organization motivate the team by giving them time to learn about that technology, or conduct workshop about that, and enhance the team moral, it kind of act lead to motivate the tem and improve the organization process[26].
4. **Improve Quality with fewer defect:** In lean model organization waste all those element which does not improve the quality, reduce the amount of time and effort it takes to product code, on every sprint and quality Assurance assure the quality and functionality of the code, and validate the customer requirement[27].

IX. CONCLUSION AND FUTURE WORK

Lean approach ensures quality of Scrum process. Lean is pretty new to Scrum, but the challenges thrown upon by Scrum can be better control with Lean. Many practices

are gaining popularity because they have proven to make Scrum Teams more effective.

Key Principles of Lean Software Development with Scrum are as follows.

1. Eliminate Waste
2. Limiting Work in Progress
3. Reduce Wait time.
4. Defer Commitment
5. Deliver Fast

Lean principles are so far supported by the several aspects of popular Scrum Framework. Lean Thinking often becomes an effective tool for Scrum Team, in connection with finding more value in perspectives of iterative and incremental development. It is found that continuous attention towards software improvement is much critical to maintain healthy development teams, as different techniques are adopted or skipped on time to time. The Lean improvement methods, as also provided in Kanban, are also accommodated through Scrum Framework. Leading to a better quality, increased productivity and less waste, it is good to pick Lean Thinking in practicing Scrum. In Scrum, it can be tricky to optimize a team's implementation. When looking for ways to improve, don't let perfect be the enemy of good enough. Perfection of Scrum is no more required but just to deliver high-quality customer-valued software, indeed to focus on things, which actually improve the product. Software Engineering is so far an emerging field, by evolving its features day-by-day, so a researcher goes for several variations and results. Future work can be of identifying reasons behind challenges of IT companies in Pakistan along with strategies to cope with these challenges in difficulties and reasons to them.

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