

A Software Process Improvement Model for Pakistan

Aasma Ikram and Mohsin Nazir

Abstract – The software industry in Pakistan is improving continuously from its current state. In order to maintain the industry and sustain the development or improvement of software industry the industry should focus on the quality oriented software. The industry should implement quality assurance programs in order to improve the quality of the industry. The basic purpose of this study is to identify the improvement in software process and also to find out the lacking areas where the improvement is required. It is also said that the SPI also leads towards improved quality oriented software. Pakistan's companies are now focusing on the quality of the software rather than the usual approach of cost cutting in the software. The research also focuses on the issues faced by the Pakistani government or software organizations in Pakistan in order to improve their current state. The software process improvement is a challenge for any organization or the nation as it involves different set of activities which helps to achieve better quality software which also helps to increase the foreign expansion of software houses in Pakistan, therefore to understand such scenarios, secondary research method have been used to conduct this research.

Index Terms – Total quality management, Software process improvement, Pakistani software industry and capability maturity model integration.

I. INTRODUCTION

IT industry plays an important role for the economy of any country. It serves every organization by having faster and easy ways of working with latest technologies. Fortunately Pakistan has been blessed with one of the best infrastructure for its software industry and also has talented and skillful labors but the government failed to improve the software industry by investing less in it which in resulted Pakistan's software industry is rated as teir-3 in software export nation's taxonomy. While China and Russia are rated as Teir-2 and India makes its software industry at the rate of teir-1 by availing the opportunity of using the right investment and talent on the right place and is known as mini superpower (software) [4].

The software industry of Pakistan failed in an international market because of lack of funds and many other reasons. The software industry requires constant changes and improvements because the technologies are improving rapidly in an international market to cope up with them the software industry have to improve its current situation on a daily basis. Pakistan's software industry failed to improve its software process and provide lack of attention towards the quality assurance activities [5]. In order to conduct this

research, we have selected secondary research method, as this paper depends on the previous studies; therefore we have studied several journals to conduct this research properly.

A. RESEARCH OBJECTIVES

- To study the ways, through which quality in the software process improvement (SPI) can be assured.
- To understand the model of software process improvement.
- To understand the factors effecting software process improvement.

II. MATERIAL AND METHODOLOGY

For conducting the research on the SPI in Pakistan and proposed model, secondary data is gathered using previously published researches and papers including the data available online on different websites. Moreover some interviews and surveys are also conducting to gather up-to-date data from Pakistani Companies. This quantitative research used different calculations including regression and co-relation for the analysis of primary and secondary data [2]. While this material can be used as research base for further studies as well as help relevant companies to get idea for improvements.

The advancing technologies are driving the needs for the implementation of the latest software in the day to day processes and procedures of the company in order to be more responsive to the demands of the customers which will ultimately help to achieve the target and the objectives that lead the company toward the success. The companies which are having some software integrated in their business must also take constant measures to improve their systems to be more efficient and effective in their processes. The study focuses on the importance of the Software Process Improvement (SPI) in the Pakistan and for the theoretical basis some previously published literature is reviewed [10].

There are several systems and methods that can be used for the improvement of current software process of the company while among all those IDEAS is also a tool which can be used for the Software Process Improvement and in this study IDEAL is evaluated and analyzed in order to identify its benefits and the issue that it can cause. IDEAL can provide guidance for the development of a plan which can be helpful for initiating and managing the SPI Program of any company [12]. The study is providing clearly defined steps for the improvement of the software process in the company. It is also stating that the companies have to use variety of resources and must plan the activities properly in order to successfully achieve the desired targets of SPI. The

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set-up of the infrastructure is also focused in the study as it plays a vital role in SPI.

The success factor for the Software Process Improvement is the organizational change of that organization. In this paper ten factors are mentioned which can affect the organizational change, while for the foundation of the discussion the Capability Maturity Model (CMM) or the Quality Standards of ISO 9000 are being used. The study is also assessing the importance of all the factors and priorities them accordingly as well as also compared the findings of the previous literatures. For the research, the data collected from the analysis of the experience reports which have been published previously and the case studies of almost 56 software organizations in which the ISO 9000 Quality Systems are implemented and the Capability Maturity Model is also being used by those companies.

This research is based on the software companies of the United Kingdom, as the data being used in the research was collected from thirteen software companies of the United Kingdom. The empirical finding of this study that is relevant to the Software Process Improvement (SPI) is identifying the motivators for the SPI. This study can proved to be helpful for the managers who are willing to implement SPI as this provides a guideline for the proper designing of the implementation process of SPI based on the strategic actions to maximize the support for the SPI. The factors which are motivating the senior managers, project managers and developers to involve in SPI, the motivators differ from practitioner to practitioner and only few motivators are affecting over the entire practitioners group [11].

There are several models and tools for the SPI out of which some are commonly used such as CMM and IDEAL which are also discussed in the above mentioned literatures. Moreover variety of factors is affective over the SPI and thus it is important to properly understand and plan accordingly in order to attain the success in the improvement of the software process as well as in the overall success of the company.

III. DISCUSSION AND ANALYSIS

A. Software Process Improvement

Software process improvement plays a vital role in development of software industry of the country in order to stay competitive in international market. SPI becomes a greatest challenge for countries and even organizations to stay and fight in a competitive environment by bringing innovations or to accept the new technologies in the software process. The software process improvement continuous through the lifecycle of the industry as it helps to get a high ranking in terms of tier in the IT sector [9]. Following is the chart providing the flow of the SPI.

B. Quality Assurance in SPI

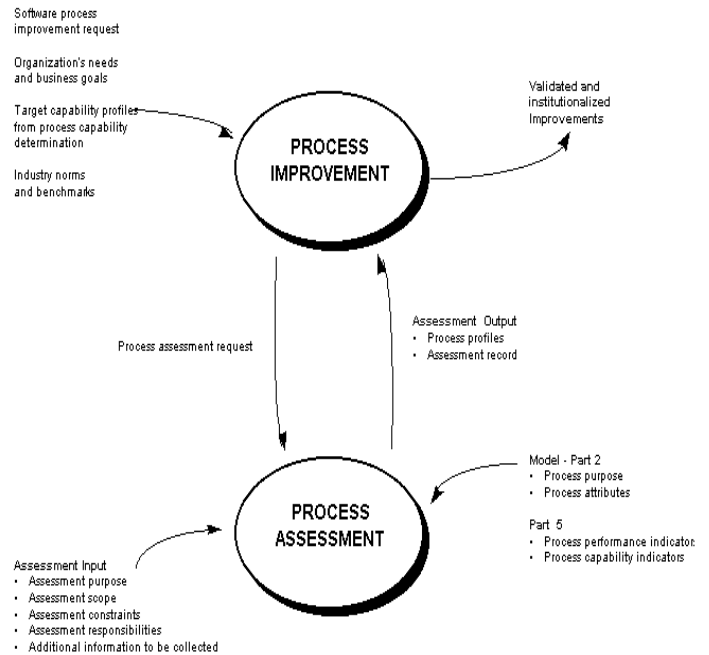


Fig. 1. Flow of the software process improvement.

The responsibility of quality assurance is for the entire industry, every stakeholder is accountable for development. The quality assurance can only be achieved through Total Quality Management (TQM) in this dynamic era of competition as it leads to continuous improvements in the process [7]. TQM not only improves the quality of the industry but also improves the management philosophies and the effectiveness of the industry. Pakistan software industry failed due to lacking interest in software quality assurance. The practitioners usually focus on reduction of cost rather than focusing on improving the quality of the software because of which it did not succeeded in international market.

C. Pakistan's IT Industry

Pakistan's software industry is amongst the rapidly improving industry of Pakistan. It generates about \$2.8 billion market share internationally. The excellent infrastructure of Pakistan for an IT industry and the cheap and talented labor of the country make a great opportunity for foreigners to invest in Pakistan's IT industry for its development.

In order to improve software industry the government also confirmed it as a tax free sector till 2016. This creates a great opportunity for investors to invest in this industry [6].

Characteristics of the Maturity Levels

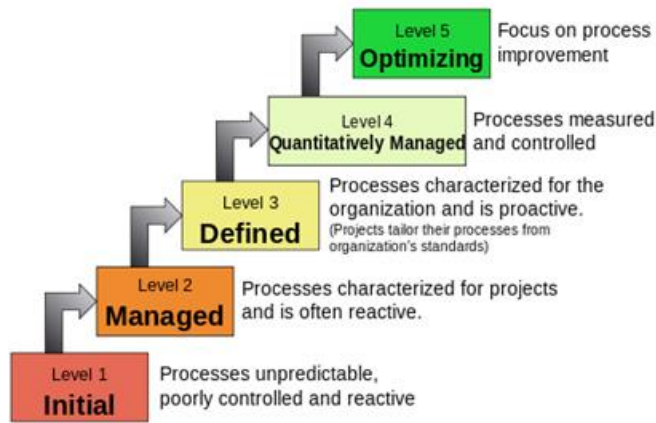


Fig. 2. Level of the capability maturity model.

As compared to Pakistan, India has become the number one software manufacturer and is known as Silicon Valley or the Asian tiger. Pakistan should follow India's footsteps as a role model for the development of software industry. Another reason for Pakistan's failure of software industry is that investors are afraid to invest in Pakistan because of its political conditions and safety measures of the country. The research sector of Pakistan is also far behind as compared to India or other countries [15].

D. SPI Model

In order to improve the software process, several models are developed for the improvement of existing software's. Some of the software improvement models are Capability Maturity Model (CMM), Capability Maturity Model Integration (CMMI) and ISO. Organizations use different models for SPI according to their needs, effectiveness and benchmarks. The widely used models are CMM and CMMI; both are designed to perfectly match the requirements of organizations regarding SPI [3].

This is CMM model, which provides a detailed framework for all the processes for the development of software industry. The time, cost and training of CMM model are very high for which small organizations used to avoid this model to implement for their SPI program. Another software improvement model is ISO 9000 which is designed to improve the quality awareness [13].

ISO 9000 is not suitable for small organizations as it is hard to apply because of its international standards. Pakistan also uses Personal Software Process model (PSP) and Team Software Process Model (TSP) in order to improve the high quality performance of teams and individuals contributing in software industry [14].

E. Capability Maturity Model Integration (CMMI) in Pakistan

CMMI model has been adopted around the globe for

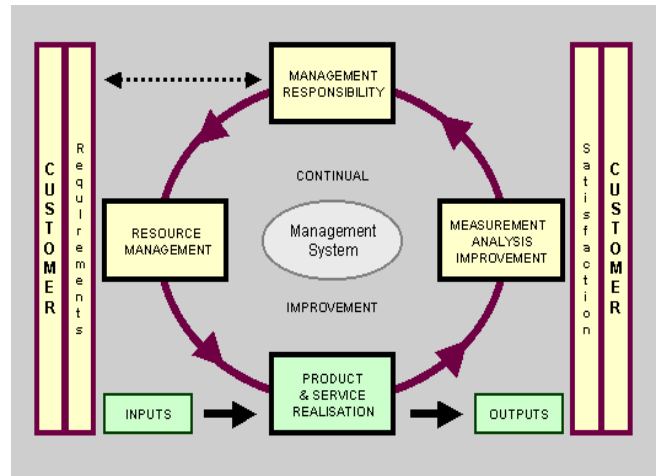


Fig. 3. ISO 9000 Quality Standard Model.

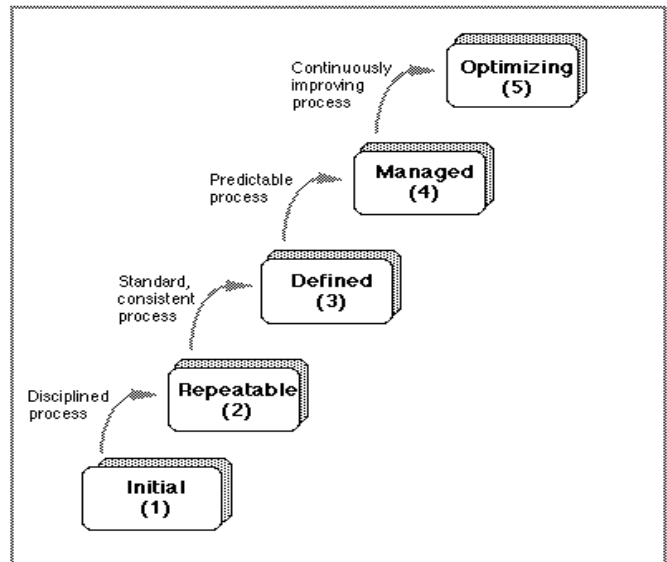


Fig. 4. Personal Software Process Model.

software process improvement. It has been recorded that more than two thousand organizations around the globe adapted CMMI model [8]. The following table illustrates different types of organizations adapted this model.

Pakistan is also using CMMI model but not on a large

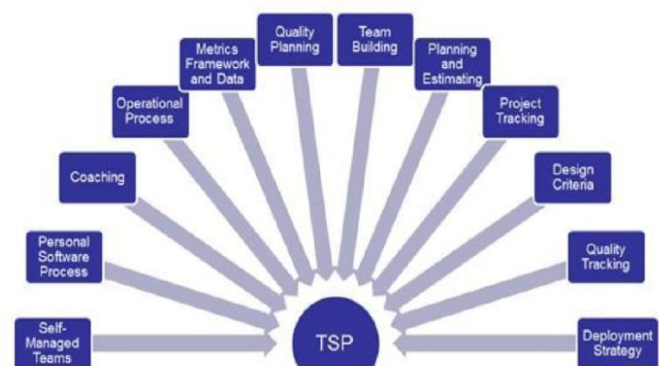


Fig. 5. Team Software Process Model.

extent. The rapidly increasing trend of usage of CMMI around the world influence Pakistan also to adapt this model in order to achieve the better ranking at its software industry just as India is adapting every latest model in order to remain leader of the IT industry. From the last decades the users, clients or vendors becomes more concerned towards the software's quality services for which Pakistan has to improve the quality of software's in order to compete in the global market by using different models and becoming efficient and productive in its software industry [4].

TABLE I: DIFFERENT TYPES OF ORGANIZATIONS THAT ADAPTED CMM MODEL.

Sr. No	Types of Organizations	Percentage
1	Federal contractors or defense department of the country	24.9%
2	Commercial department or in house using	70.5 %
3	Military or federal department	4.6 %

Pakistan achieved the CMMI certification in 2002, but because of the political changes, Economic recession in the international market, war against terrorism in different regions of Pakistan and other unavoidable circumstances Pakistan's software industry instead of boosting up suffered a lot. Because of these consequences Pakistan's organizations changes their plan of using CMMI model [5].

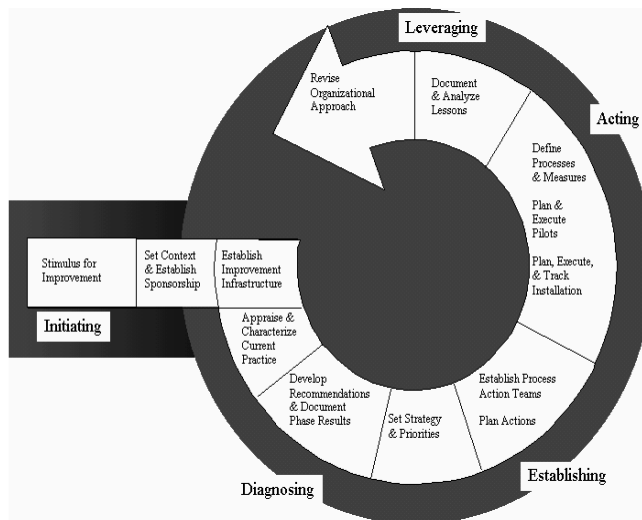


Fig. 6. ISI Model.

Some of the organizations in Pakistan such as NetSol broke the ice in 2002 and introduced CMMI practices in its

organizations. NetSol started practicing CMM at level 2 for organization's internal process improvement. In order to implement CMMI in other organizations of Pakistan PSEB launched different plans and sets of standards to implement the CMMI in the software industry of Pakistan. PSEB selected different software related organizations such as NetSol technologies, Systems (Pvt.) Ltd, KalSoft Ltd. etc.

F. Factors Effecting SPI

Pakistan is practicing the software improvement programs and models in order to boost their software industry but some of the factors de-motivate organizations to improve their existing state. The factors which effect the improvement of software process in organizations are lack of resources, lack of management involvement or supports, organizations environment and politics, lack of benefits, cultural issues and unguided goals. The factors which disrupts the improvement program depends on the small and large firms issues of their management and employee involvement [1].

IV. CONCLUSION

Pakistan's software industry strives to improve the quality among its products for which different quality assurance models such as total quality management is implemented in different software companies. The vendors and customers around the world are now more focused on the quality of the product rather than cost reduction for which Pakistan has to increase the quality of the products to improve its position in the international market. Different software improvement models are launched around the globe to improve the efficiency and productivity of the software industry, Pakistan also uses different models in order to improve the software process such as CMM, CMMI, ISO9000, PSP and TSP. Pakistan has about 700 software housing companies, but unfortunately only 25 companies' adopted CMMI implementation in their organization. Pakistan needs to implement different software process improvement model such as CMMI and CMM in its software development industries in order to improve its position in an international market. Similarly, on the other hand, to maintain the industry and sustain the development or improvement of software industry, it is recommended that industry should focus on the quality oriented software's. Furthermore, the industry should also implement quality assurance programs just to improve the quality of the industry.

REFERENCES

- [1] Adnan, S., Ullah, K., & Shouting, G. (2016). Investigations into Precipitation and Drought Climatologies in South Central Asia with Special Focus on Pakistan over the Period 1951–2010. *Journal of Climate*, 29(16), 6019–6035.
- [2] Aydelotte, W. O., Fogel, R. W., & Bogue, A. G. (2015). The dimensions of quantitative research in history. Princeton University Press.
- [3] Belayneh, A., Adamowski, J., & Khalil, B. (2016). Short-term SPI drought forecasting in the Awash River Basin in Ethiopia using wavelet transforms and machine learning

- methods. *Sustainable Water Resources Management*, 2(1), 87-101.
- [4] Belayneh, A., Adamowski, J., Khalil, B., & Quilty, J. (2016). Coupling machine learning methods with wavelet transforms and the bootstrap and boosting ensemble approaches for drought prediction. *Atmospheric Research*, 172, 37-47.
- [5] Engdashet, T., Machado, R. J., & Midekso, D. (2016). Integrated Framework of Agile and CMMI: An Alternative Path towards Product Focused SPI for Small Companies. *Lecture Notes on Software Engineering*, 4(1), 1.
- [6] Haroon, M. A., Zhang, J., & Yao, F. (2016). Drought monitoring and performance evaluation of MODIS-based drought severity index (DSI) over Pakistan. *Natural Hazards*, 84(2), 1349-1366.
- [7] Khalid, S., Shehryar, T., & Arshad, S. (2015, March). The role of knowledge management in global software engineering. In *Industrial Engineering and Operations Management (IEOM), 2015 International Conference on* (pp. 1-5). IEEE.
- [8] Seçkin, N., & Topçu, E. (2016). Drought Analysis of the Seyhan Basin by Using Standardized Precipitation Index (SPI) and L-moments. *Tarım Bilimleri Dergisi*, 22(2), 196-215.
- [9] Vicente-Serrano, S. M., & Beguería, S. (2016). Comment on 'Candidate distributions for climatological drought indices (SPI and SPEI)' by James H. Stagge et al. *International Journal of Climatology*, 36(4), 2120-2131.
- [10] Hashmi, A. A., Mansoor, A., & Khokhar, N. (2013). Quantitative Analysis of SPI in Pakistan. *International Journal of Computer and Electrical Engineering*, 5(5), 464.
- [11] Ali, T., Akram, A., Fatima, S. A., Yousaf, I., ud Din, A., & Shakir, M. W. (2016). Consistency Enhancement in Key Process Areas of CMM during SPI Practice. *International Journal of Computer Science and Information Security*, 14(5), 425.
- [12] Xie, H., Ringler, C., Zhu, T., & Waqas, A. (2013). Droughts in Pakistan: a spatiotemporal variability analysis using the Standardized Precipitation Index. *Water international*, 38(5), 620-631.
- [13] Shah, M., Shah, A. S., & Ijaz, I. (2016). Implementation of User Authentication as a Service for Cloud Network.
- [14] Khattak, N. U. R., & Tariq, M. (2012). A Real Exchange Rate based Phillips Curve Model for Pakistan. *International Journal of Business and Social Science*, 3(5).
- [15] Hanif, M. N., & Malik, M. J. (2015). Evaluating Performance of Inflation Forecasting Models of Pakistan. *Basic format for books*: