Software Project Risk Management by using Six Sigma Approach

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ABSTRACT- Risk controlling in software projects is considered to be a most important contributor to project success. Six Sigma is being used in the industries and business sectors as a project management method to authenticate goal of near to excellence in process accomplishment and execution. It is one of applications in several organization and business processes to attain major performance enhancement in different industrial and business sectors including the IT sector. Six Sigma require across-the- board framework for effective risk management because root cause analysis (RCA) is still the primary and most important practice used for managing risks in this methodology. In this research, we have endeavoured to put forward an investigation in order to improve quality and productivity of Six Sigma projects, predominantly in the IT development projects. The study also included detailed overview of the current methods being practiced for risk identification, mitigation and management in Six Sigma.

Keywords — Risk Management, DMAIC, DMADV, Six Sigma, Risk Management

I.   INTRODUCTION

In modern software projects, security and risk management are not just something one might do if there are time and resources. Software Project Development and its Execution is on the whole a difficult task as we are going to produce new product, proper research is required before development process, beside that we are facing high risk factors too. Though, we have methodologies to identify a number of risks in earlier stages but probability of failure is still very high. The major issue is that same techniques and methodologies cannot be applied on every type of project as the risk type for every project differs [6].

Our objective in this research is to provide a methodology for risk management that can serve in several aspects. Technically, it would help project managers to adopt methodology which will be best fir for their projects. On the other hand, it would help for further studies that aim to improve the software development process by identifying risk in earlier stages of development [6].

Security has become an important part of the end product. Six Sigma is a quality standard used in industries and corporate sectors. So it has always been a burning issue to research, methods and tools to identify and eliminate risk from IT projects. We are motivated with the specialized tools and techniques offered by Six Sigma, Six sigma is s series of best practices that can enhance manufacturing procedures and reduce defects, so it is also called a problem solving methodology. As we know risk identification and management is a major issue in every industry including IT in real time environment. Therefore, it‟s a collective effort for this research. We have focused on both approaches of six sigma: - measure-analyse-improve- control (DMAIC) and define-measure-analyse-design-verify (DMADV) also called Design for Six Sigma (DFSS). Six Sigma is based on DMAIC idea and focuses on to discover the core cause of the problem using statistical methods. Risk analysis includes risk identification and to minimize their effects to make a successful project.

In this paper we have analysed different techniques and methodologies currently using in software development life cycle. We have shown their capability to identify and manage risks during SDLC. Suggestions made for choosing better methodology for different types of projects for development of risk management process [8].

Risk identification and its mitigation collectively called as risk management which is a core part of any project. In six sigma this part of a critical phase called Risk Cause Analysis (RCA). For this purpose first of all core reason is identified that can cause defects in final product, then a table is designed in which defects/risks are prioritized and found their severity to apply tools accordingly. In this paper we have given an overview of existing techniques used for risk management. In the end we have concluded whole literature review in the form of a table and conclusion.

II. LITERATURE REVIEW

Sinovcic and Hribar [1] in their research they applied different software quality prediction techniques to indicate existing faults in software project and financial management. They have analyzed three case studies including Nokia, Ericson and Tesla for the purpose of research. They pointed out that if we want to improve software fault handling process we should have best understanding of software faults, their distribution and association with prediction model. With this knowledge we can apply improvement techniques more efficiently to avoid loss of resources. They suggest that Product Life Cycle Management (PLCM) supports to transform customer needs into desired product with best use of resources and avoiding risks.

Vojo and Bubevsk [2] discoverd that the conservative approach to Risk Assessment and Management in Software Testing is based on investigative models and statistical analysis and projected a model. They showed that investigative models are fixed, so they do not give any explanation for the inbuilt changeability and uncertainty of the testing process, which is a clear deficit. In this paper they presented application of Six Sigma and Simulation in Software Testing. In Sig Sigma we have two techniques DMAIC and DMADV, they adopted one of them that is (define-measure-analyze-improve-control) DMAIC in testing process to evaluate and mitigate the risk to make delivery of the product on time, achieving the required quality goals.

Tariq [3] find out that Six Sigma with its countless implementations in many organizational and business procedures can help in project management methodology. It also supports in accomplishing goals near to perfection in process performance. Six Sigma is supported by the momentum of Plan-Do-Check-Act; it can help manufacturing industries, businesses and institutions to attain major performance perfection. Six Sigma involve DMAIC and DMADV methods for attaining a standard of high quality. In this paper they analyze critically the applications, techniques and tools of Six Sigma range that are used for improvement of quality and efficiency of the different business procedures. Their research also present an analysis of processes used for risk recognition and lessening in Six Sigma.

 Ekananta [4] explored that software development project is an unsafe task due to the ambiguity of the consumer requirements, the complications of the method, and the fuzzy nature of the manufactured goods. Keeping in view all these circumstances, risk management is not easy and costly to put into practice. A perfect software development project is depends upon the preliminary planning about scope of the project, schedule, cost and available resources for that particular project. This research combines together COCOMO and Fuzzy logic. They validate their approach with business data and shown that fuzzy-ExCOM offered improved risk evaluation outcomes with a better understanding to risk recognition contrast to the original Expert COCOMO technique.

Haneen [5] make comparison of existing software development procedures. To choose the technique that will best suits for a particular software development depends upon many factors. Most significant feature is to identify how uncertain that project would be. Another important issue is to evaluate each tactic and chose best one that will also support risk management. This paper reveals that they look into the situation of risk and risk management in the most well known software development procedure models including waterfall, v-model, incremental development, spiral, and agile development method. Their research will help researchers and project managers to choose best methodology that will help them in development and for risk management too.

Tariq [6] again investigate that Six Sigma is being used as project management methodology in different manufacturing industries and business sectors to authenticate their goals near to exactness in process completion and implementation In this paper, they projected a framework for risk recognition and management to get better quality and output of six sigma projects especially the IT development projects. This research paper also covers a condensed overview of the existing techniques being in practiced for risk detection in Six Sigma projects. The proposed framework will help us to identify risks in real time environment by using six sigma tools and techniques to produce better quality products in IT sector.

Abbas [7] describe that ERP systems are compound software systems that business organizations use to administer their resources. From first step of development of ERP system life cycle to its end it supposed to face plenty of risks that have to be identified and suitable actions should be taken to overcome or avoid these risks, so it could not effects the whole project life cycle. They proposed a system Enterprise Sustainability Risk Management (ESRM) for ERP projects for their successful completion. Their results shown that like other risk Staff risks is a major risk that should be identified as it has affect the end results. ESRM can also be used for project other than ERP as it is a general model to manage risks.

Azlin [8] conclude that Risk management (RM) has always been the burning issue for the software project management

studies. The major purpose of RM is to identify risk and its associations and then to make strategy for its elimination according to its nature. In this paper they make comparison of different models for risk management. They conclude that risk should be identifies during requirement gathering from experts and customers. This paper also gives information about the results of the survey regarding the most wanted features for risk management tool (RMT). After concluding results, the authors suggested, planned and developed the tool to automate the Boehm''s Risk Management process.

Frank [9] aims in their empirical study was to clarify managerial and customer related challenges in software developing companies that affect the software testing process and how afterwards these challenges affect software quality building. This research pointed out testing challenges which negatively affect the quality of the product. Finally it was concluded that software quality also based on organizational structure and movement of information from customer to development team. The team leader play an important role in this process, if he will provide correct information about the required product, the result will be near to perfection otherwise, it will led to errors, ambiguities and failure of the project.

Irena [10] presented their paper a model system integration technical risk assessment model (SITRAM), which is based on Bayesian belief networks (BBN) joined with parametric models (PM). They proposed a theoretical modeling approach to deal with the problem of System integration technical risks (SITR) measurement in the beginning of a system life cycle. The suggested approach includes a set of BBN models which represents associations between risk causing elements, and complement PMs which is used to supply input data to the BBN models. Initially, BNN model is used to identify risks, PMs provides risk relationships and then combine them to form a hybrid model by selecting Boehm''s approach.

Shihab [11] said that a lot of research is being conducted to find out the ways to assure software quality. One line work that has been getting an escalating total of interest is Software Defect Prediction (SDP), where calculations and forecast are prepared to conclude where future defects would appear. He provides an approach that will predict major defects and also provide a simplified model of SDP that is easily understandable. While development risky changes may not make defects but they can delay the release of product. In his proposed approach we can predict risky changes and implementation of SDP for predicting risks before they become a part of coding.

Janjua [12] proposed responsibilities for ,,risk managers ,,as they assumed to be responsible for the whole process of risk management. But in of software engineering field this term "risk manager" is not clearly defined and having uncertainty over the term''s meaning. After studying many research papers about risk management but we still don''t have clear picture about the person who will handle all these tasks of risk management. It is difficult for an organization to find a professional Risk Manager for software development project so it is suggested to make team leader as risk manager as they already have risk analysis, management and software engineering knowledge.

3)   TABLE 1: ANALYSIS OF RISK MANAGEMENT TECHNIQUES

Author	Method/Technique	Key characteristics	Key points
Sinovcic I and L.Hribar [1]	PLCM	Identified existing faults in software projects using three case studies.	PLCM supports to convert customer need into end product and avoiding risks.
Vojo and Bubevsk [2]	DMAIC technique of six sigma	Six sigma metrics used to determine probability of defects in testing.	Six sigma is combined with CMMI for performance driven improvement.
Usman [3]	Six sigma, DMAIC and	Critical analysis of different	An approach into the current perceptive,

	Lean	techniques for quality and productivity of an organization.	practices and applications of Six Sigma.
Ekananta [4]	Fuzzy technique and COCOMO	A model proposed by combining Fuzzy technique and COCOMO.	Proposed model provides identification, analysis and prioritization of risks.
Haneen [5]	Highlights risky areas of leading software development models.	Comparison of leading SDLC model with respect to risk management.	Investigated state of risk in each software development methodology.
Tariq [6]	Risk identification using six sigma	Identification of a number of unpredicted risks and their statistical analysis	Proposed framewo rk can be used for IT project and other projects as well.
Abbas [7]	Risk identification, reduction and control in .. ERP projects	Identification of staff risks that effects project failures.	Proposed ERMS as generic model for risk management
Azlin [8]	Boehm¨s RM process	Steps of RM process based on Boehm¨s model	Developed the tool to automate the Boehm¨s RM process.
Shihab [9]	Proactive risk management	Identifies how SDP research helps software engineers.	SDP used for prediction of defects before coding.
Frank [10]	Grounded theory research method	Identification of Customer and organizational challenges	Organizational structure also effects software quality.
Irena [11]	SITRAM, BBN	Identification of risks and relations between risk factors	Proposed model combines BNN and Boehm¨s model
Janjua[12]	Comparison of different theories about risk managers	Classifications of risk managers according to their role in RM.	Identification of responsibilities of risk managers.

IV.   CONCLUSIONS

This study highlighted a significant overview of different techniques that can significantly get better the quality and output of different organizations particularly related to IT. A proper research lacks that can combine together the risk management in operating environment with the organizational tactics. Besides, this study also insight into the credible processes that can be efficiently implement for risk detection within the Six Sigma framework [3]. This study also highlighted the significance of six sigma approach in achieving better quality, capability, efficiency and stability of procedures. Six Sigma had already been implemented by a numerous organizations worldwide but the research in this domain is still in its premature phase. The base of six sigma is variation reduction [6].

This study also analyzed the various approaches used for risk management in different circumstances. In this research we

started from risk identification, then goes with different models and approaches used for this purpose including the role of risk managers in managing risk properly and the structure of the organization which also effects the project management. We can say that Six Sigma provides a better approach for quality and risk management with cooperation of an experienced risk manager.

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