Need for Effective Risk Management Strategy during Software Development Process – A Holistic View

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ABSTRACT

Risk management in software development is one of the well-known methods for successful software development strategy. This is because though risks can affect all parameters of the project, it specifically influences those parameters which are deemed to be modulating the success nature of the project based on the severity of the risk. This paper therefore provides a sample of few risks and put forth their holistic view on the types of severity encountered during project development. This knowledge further throws light on the fact that if risks are not attended at the right time, they can propagate further and cause hazardous impact on the project deliverables.

Keywords —**Software Engineering, Risk Management, Risk Impact, Risk Severity, Software Project Management**

I. INTRODUCTION

Risk Management in software industries, always plays a constructive role in terms of organizational development. Every industry combats its best to sustain the number one position in the competitive market. Dealing with the challenges is an on-going process in the current scenario of IT domain to maintain the sustainability of software companies. Lack of focus in dealing with the challenges can be detrimental to the IT companies. Among several challenges, managing software project risks/uncertainties can be one of the major role players in the success of the organization.

Occurrences of risk are inevitable in every software industry, also in the process of development of the software. Potential threats that are seen duringdevelopment of software thusneed continual attentionin order to manage the probable failures. An effective risk management strategy in the organization is therefore mandatory to ensure the quality of the project and its strength to maintain its viability with the contenders. The positive impact of accepting risk management strategies on projects has led software organizations to appreciate itshighly effective role in the quest of cost reduction, reduction in schedule overruns and to have improved performance [1].

Every software project in an organization has its own methodology of solution to manage risks that occur in the software development process. Resolving risks however depend upon several factors such as project domain, type of client, quality standards of the project, given time frame, budget, geographical region, resources, cultural background, and skill set of the resources and so on. It is worth to note that aforementioned factors have a tendency to contribute for risk occurrence at every phase of software development. Hence, effective risk management is one of the fore most activities of software development process.

II. LITERATURE SURVEY

Authors of [3] have analyzed the publications of international journals that happened between 1978 and 2012 to arrive at an implicit decision that risk management performed for the favor of project success.

According to authors of [4], there are five basic risk factors requirements analysis risk, project communication risk, schedule risk, risk of system design, and risk of project cooperation. They have found a causal relationship among these 5 factors and proposed a structured risk model.

While managing multiple software development projects in IT industries, risks being unavoidable, authors of [5] have proposed a risk point metric that can be applied as support tool for decision making and risk monitoring.

Authors of [6] have proposed risk indicators with respect to the environmental factors to support risk assessment activities which in turn bring down the occurrence of potential failures in software development environments.

Authors of [7] emphasize on incubated technology based on the project data collected from different companies after conducting literature survey on risk management analysis on different software development projects.

A framework for risk management with respect to every software development project is proposed by author of [8] to understand project manager's perspective and to indicate on priorities.

Authors of [9] have come out with 5 different classification methods for prediction of impact caused by risks and two filtrate methods to prioritize risk factors.

Authors of [10] have built- two discriminant models to classify risks in design and build projects in terms of cost, time and quality related risk groups. The purpose of these models is to improvise risk management and mitigation methodologies.

III. HOW TO ADDRESS THESE RISKS?

Despite of advent in technology and having effective risk management team, it is still not possible to detect all the risks or eliminate them completely. One of the rationales for such undetected or unresolved risk is due to the fact that risk can occur at any phase of software development in addition to the propagation with amplified and rippled impact. Also, there is no ideal model that fits all the software development projects; in certain circumstances each model has its advantages and disadvantages [2]. Hence, such type of risks needs to be prioritized and analyzed to bring down their impact on the quality of the software. Also, this prioritization should be done keeping in view, the essential and most affecting parameters of the project i.e. Cost, Time, People and Process (CTP^2) that reinforce the success of the industry [11]. According to the conventional Risk Management strategy, risk needs to be initially identified and prioritized based on the probability, frequency and impact. A risk is deemed to be of high priority, if it is expected to leave a disastrous impact on the project in terms of CTP^2oreven if it has higher frequency of occurrence. Hence, they need to be immediately attended and resolved. Therefore, the severity of the risk is dependent on both the impact and frequency of occurrence. Once the priority is set, a mitigation plan will be applied on these risks in order to address them. The results of the mitigation plan can be either to avoid the risks or to bring down their impact on the project.

IV. WHAT HAPPENS WHEN RISKS ARE NOT ADDRESSED?

Based on the data collected from different IT industries and various software development projects, a criterion to understand the impact of risks on the success deriving parameters of the project i.e. CTP^2 has been arrived at.

TABLE 1 suggests a template which is again an impact measuring criteria of potential risks which deals with the severity (danger zone) of the risk in terms of success parameters CTP^2 (Cost, Time, People, Process).

Here are the details of severity that a project reaches whenever a risk occurs :

According to TABLE 1,

A. Severity 1

Severity 1 is the state when the cost of the project increases by 80%-100% of the original cost.Or due delay in project delivery which would increase beyond 30 days or due to increase in number of manual resources by 80% to 100% of original number. Or if the effort to be put in the project development increases from 80% to 100%.

B. Severity 2

Severity 2 is the state when the cost of the project increases by 60%-80% of the original cost. Or due delay in project delivery which would increase by 20 to 30 days or due to increase in number of manual resources by 60% to 80% of original number. Or if the effort to be put in the project development increases from 60% to 80% .

C. Severity 3

Severity 3 is the state when the cost of the project increases by 80%-100% of the original cost. Or due delay in project delivery which would increase by 5 to 20 days or due to increase in number of manual resources by 30% to 60% of original number. Or if the effort to be put in the project development increases from 30% to 60% .

D. Severity 4

Severity 4 is the state when the cost of the project increases by 10%-30% of the original cost. Or due delay in project delivery which would increase by 1 to 5 days or due to increase in number of manual resources by 10% to 30% of original number. Or if the effort to be put in the project development increases from 10% to 30% .

TABLE 2 illustrates a sample of risks taken from different software development projects developed in various software industries in order to understand impact of risk on the process. In the table, Risk ID uniquely identifies the risk while Risk Description gives the details of the occurring risk. TABLE 2 also indicates phase in which risk got injected and detected in addition to the observed severity level. TABLE 2 also provides information about consequence of risk in terms of success of the project.

Every software development project has its own strategy of measuring the impact of these risks through which prioritizing becomes much more easier which further helps to take mitigating action soon.

Risk Severity Table (TABLE 3) suggests one more impact measuring strategy to retaliate for the coming up hazardous effects.

From TABLE 2, it is evident that if the risks are not identified at the right time (time of occurrence /injection), it can propagate further along with increase in its catastrophic effect [13]. Thus, it can leave a ruinous consequence on essential parameters of the project i.e. CTP^2.

TABLE 3 clearly illustrates the impact of the risk on the success parameters at each severity level. Also it can be seen that every success parameter or a combination of the parameter (as shown in TABLE 2) will be hit at every level of severity.

The graph in Figure1 reveals how risks and their severity get propagated to the higher extent if risk management strategy is not applied at the right time.

Figure1 shows that if the risks are not monitored periodically or the focus on the occurrence is not given at right time, risks get magnified in terms of severity in an exponential manner. In the given graph, risks that are numbered from 1 to 8 are marked in blue to represent their severity at the time of occurrence. The red bars convey that the severity increases for the same risks if they are not identified at the right time in the software development projects.

From the sampled type of generic risks (TABLE 2) as observed in real time projects, it is clear that impact of risk is always a threat to the quality of the software developed. Hence, it is strongly recommended to have not just reactive model of risk resolving technique but also to incorporate proactive model where anticipated risk can be prevented from injection than detection and elimination.

V. CONCLUSION

Every phase in software development process has its own set of challenges to be taken care. Even though every project follows a well planned development process, uncertainties are inevitable. Hence, it is always good to have a proactive risk management strategy at every phase of software development which needs to be executed in a periodical manner. Besides mitigation, risks have to be monitored, controlled and measured at each phase of the project.

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TABLE 1. RISK IMPACT MEASURING TEMPLATE

Project Success Parameter	Severity 1	Severity 2	Severity 3	Severity 4
Cost	Increase in cost (80%≤ C ≤ 100%)	Increase in cost (60%≤ C ≤ 80%)	Increase in cost (30%≤ C ≤ 60%)	Increase in cost (10%≤ C ≤ 30%)
Time	Delay in deliverable T≥ 30 days	Delay in deliverable 20≥T≥ 30 days	Delay in deliverable for 5≥T≥ 20 days	Delay in deliverable for 1≥T≥ 5 days
People	Increase in number of resources (80%≤ P ≤ 100%)	Increase in number of resources (60%≤ P ≤ 80%)	Increase in number of resources (30%≤ P ≤ 60%)	Increase in number of resources (10%≤ P ≤ 30%)
Process	Increase in effort (80%≤ Pr ≤ 100%)	Increase in effort (60%≤ Pr ≤ 80%)	Increase in effort (30%≤ Pr ≤ 60%)	Increase in effort (10%≤ Pr ≤ 30%)

C – Initial Estimated Cost, T – Initial Estimated Time, P – Initial Estimated Human Resources, Pr – Initial estimated efforts (in terms of hardware, software, project development techniques, testing techniques, project management strategies)

TABLE2.SAMPLE OF RISKS AND THEIR IMPACT

Risk ID	Risk Description	Risk Injection phase	Severity	Impact Traced Phase	Severity	Result	Impacted Success Parameter
Risk 1	Unresolved Assumptions	Requirements Gathering	4	Production	1	Rejection from Customer	Process
Risk 2	Prototype mismatch with software	Design	4	Implementation	1	Re-Design	Time
Risk 3	Contradictory priorities	Requirements Gathering	4	Testing	1	Re build and Test	Time
Risk 4	Miscommunication with the outsourced companies	Overall Project	3	Implementation	1	Rework	Cost
Risk5	Project having multi users	Requirements Gathering	4	Production	1	Rejection from Customer	Process
Risk 6	Several APIs	Design	3	Implementation	1	No consistency in the flow of information across the APIs	Time, Process
Risk 7	Change in requirements not handled in parallel with change in test cases	Design	4	Testing	1	Re-designing Test Cases	Time, Process
Risk 8	Implementation of requirements without changes in prototype	Design	3	Implementation	1	Rework	People, Process

TABLE3. RISK SEVERITY TABLE

Severity	Impact	Impacted Success Parameter
1	Catastrophic	CTP^2
2	High	CTP^2
3	Moderate	CTP^2
4	Negligible	CTP^2

(C-Cost, T-Time, P-People, P-Process)

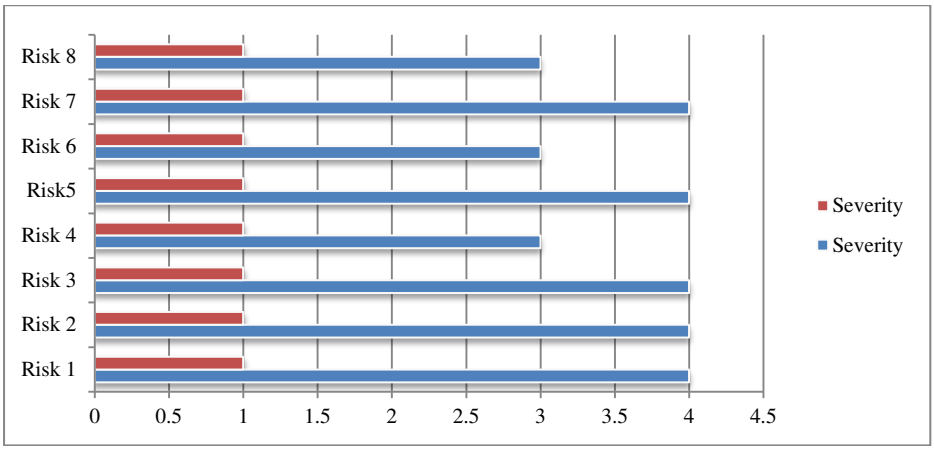

Figure1. Graphical representation of Risk Propagation