A framework for risk management in XP development process

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Abstract

Risks are an integral part of any software project. Risks in the software development project environment need to be carefully identified so as not to lead to project failure. Proper identification and monitoring of risk factors can ensure the success of software development projects and software quality. The agile process in a project must be adapted to an agile environment in which the focus is on development in smaller iterations and changes often occur and a client is expected to be very involved in the process. This naturally affects the risks that agile projects may face. As a result, software companies need an explicit risk management process to reduce risks and address problems before they occur and to control overall project management. Therefore, in this paper, a framework for integrating risk management based on ISO31000 in agile development projects is presented and for this, XP methodology is considered as an agile method. The main objectives of this framework are to improve the risk management mechanism in XP and increase the success rate of the XP project.

Keywords: Risks; XP Methodology; Risk Management; Framework; Software Development Project

I. INTRODUCTION

Researchers have cited some of the reasons for the multiplicity of failures in IT projects as the inadequacy of risk management mechanisms and processes, as well as the negligence of project managers in implementing them. Projects that do not manage their risks effectively will face greater risks.

The American Institute of Project Management (PMI) identifies risk management as one of the twelve core levels of project knowledge, in which it manages risk management through all processes related to identifying, analyzing, and responding to any uncertainty, including maximizing desired event outcomes. Minimizing the consequences of adverse events is considered. Errors and failures in software projects have a warning statistic that lack of risk management in the project process can be mentioned as one of the causes. Software risk management has approaches, processes, tools, and methodologies for risk management in software projects.

Simply put, risk is a potential problem. Risk is an activity or event that could jeopardize the success of a software development project. Risk is the probability of incurring a loss, and total risk is the sum of the losses and the probability of risks that could occur to a project. Often, speculation or crisis management is not effective in dealing with software risks, and the only solution is to identify and consolidate the risks in a predictive method to obtain the ultimate risk probability of a software development project. The risks of a project can be termination, interruption, planning delays, miscalculation of costs, and problems with project resources. [1,2]

Currently, Extreme Programming (XP) is considered as the most famous and prominent agile methodology [3]. XP is based on twelve best practices [3, 4, 5] of which the following are core practices: Customer on Site, Planning Game, collective Code Ownership, Simple Design. Also,

the risk factors that might occur if the Simple Design practice is not applied include changing requirements [14]. In [15] various tools for Risk management in the area of software including Vanguard studio, Pertmaster, RiskEase, CrystalBall 7, RiskTrak [4, 6, 10, 13, 19] was reviewed. Also, in [15] a risk management tool for XP is designed using MS-Excel 2007. This tool requires the definition of project budget and risk budget percent for each XP practice.

This study aims to create a new framework incorporating the principles of risk management and techniques into XP development Framework based on ISO31000. This will facilitate teams to manage easily the risks in the XP project and to improve the chances of a successful project.

This paper is organized as follows: section II reviews the existing risk management tools and works. Section III presents the details of the proposed risk framework. Section IV presents some results obtained by the framework and we evaluated the framework of risk management to determine its effectiveness. Finally, the conclusion and future work are given in Section V.

II. BACKGOUND

Software risk management was recognized as an independent research field in 1989. The risk-based spiral life cycle model was the first software life cycle model in which risk management was clearly seen. From the early 2000s, the software industry shifted to agile and lightweight methods that, unlike traditional methods, were prone to many changes. The move from traditional models such as waterfall models to agile methods has created new challenges in risk management [2] .In general, XP and other agile methods do not offer specific activities to support risk management. As a result, XP professionals are not fully aware of the risks, but follow an implicit risk management process. Because they think that rapid development cycles minimize the unpredictable effects of product development, but that is not enough.

Since XP methodology is considered as an agile methodology, in order to review previous studies, papers and dissertations related to the topic of risk identification and management, all agile methodologies such as Scrum and especially XP methodology have been studied. Here are some of the most important ones:

1. In [16], the authors developed a framework for improving software development in Scrum as one of the agile methodologies. This model consists of five steps (e.g. risk identification, risk transparency and quantification, risk response planning, risk monitoring and control, risk assessment). The model is limited to a general model instead of examining and developing each aspect of risk management in Scrum.

2. In [17], the authors proposed a lightweight risk-based experimental method for the scrum framework. To conduct an experimental evaluation, a case study with 6 teams was conducted.

3. Risk identification and mitigation processes for using Scrum in software development are suggested in [11]. This framework is for project managers looking for ways to use Scrum in their distributed projects. Their purpose is to identify the main risks associated with the underlying factors of the project when using Scrum in software development projects, as well as to review strategies to reduce these risks.

4. In [4], the authors developed a risk management model in an Agile tool that uses software agents to support risk identification, assessment, and monitoring.

5. In [18], the authors attempted to discover the extent of risk management practices in agile information systems development projects using the Dynamic System Development Method (DSDM). This analysis includes the analysis of the main elements of risk management, i.e. identification, estimation and evaluation of risks.

6. In [19], which is a review paper, the risks to the agile process and the risk reduction strategies used are examined, and for this purpose, the authors conducted an online survey with 54 agile methodology teams.

7. In the master thesis [7], the author examines how the risk management of the engineering requirements phase is done in agile projects and how the choice of agile development method affects the risks of this phase of the software development process.

8. Book [8] is a definitive guide for IT managers and agile method professionals. This book clarifies the principles of agile risk management. In this book, the terms project risk management and agile techniques are clearly and concisely explained and demonstrated using agile methodologies such as XP, Scrum and DSDM.

9. In [9] the authors have developed a risk management tool specifically for software development with XP methodology that has been designed and developed using Excel to provide information such as project budget, risk management budget, cost control for decision making. Keep track of which method should be used first and keep it.

10. The paper [10] presents a framework for risk management in Scrum and in this paper, it is stated that other methodologies such as XP methodology need this framework for risk management and suggests it as future work.

11. In the paper [21] the authors developed the tools for project that use agile methods base on the collection of risk management practices and an iterative lifecycle. They used agile subcomponents list that mapped to the risk management lifecycle that has ranked from most important to lowest.

In summary, none of the previous work involved a complete software development process and did not cover all stages of risk management in the agile life cycle. Also, based on the reviews, none of the papers have fully identified and categorized the risks of the software development process in the XP methodology, and no framework has been developed for managing the risks of this methodology.

III. PROPOSED MODEL

We used the ISO 31000[20] standard for risk management and our proposed framework that we integrated with the XP steps. This framework consists of 6 steps as shown in Figure 1. We review each step of this framework, which includes several tasks:

A. Communication and consultation

The purpose of communication and counseling is to help relevant stakeholders understand the risk, the basis of the decision and the reasons for the need for specific action. Communication used for raise awareness and understanding of risk, while counseling involves obtaining feedback and information to support decision making. Close coordination between the two should facilitate the exchange of real, timely, relevant, accurate and comprehensible information, considering the confidentiality and integrity of information as well as the rights of individuals.

Communication and consultation with appropriate external and internal stakeholders should be done at all stages of the risk management process.

Communication and consultation aim to build a sense of inclusiveness and ownership among those affected by risk.

B. Scope, context and criteria

The organization should define the scope of its risk management activities.

Risk management process may be applied at different levels (e.g. strategic, operational, program, project, or other activities), it is important to be clear about the scope under consideration, the relevant objectives to be considered and their alignment with organizational objectives.

When planning the approach, considerations include:
— Objectives and decisions that need to be made;
— Outcomes expected from the steps to be taken in the process;
— time, location, specific inclusions and exclusions

— Appropriate risk assessment tools and techniques;
— Resources required, responsibilities and records to be kept;

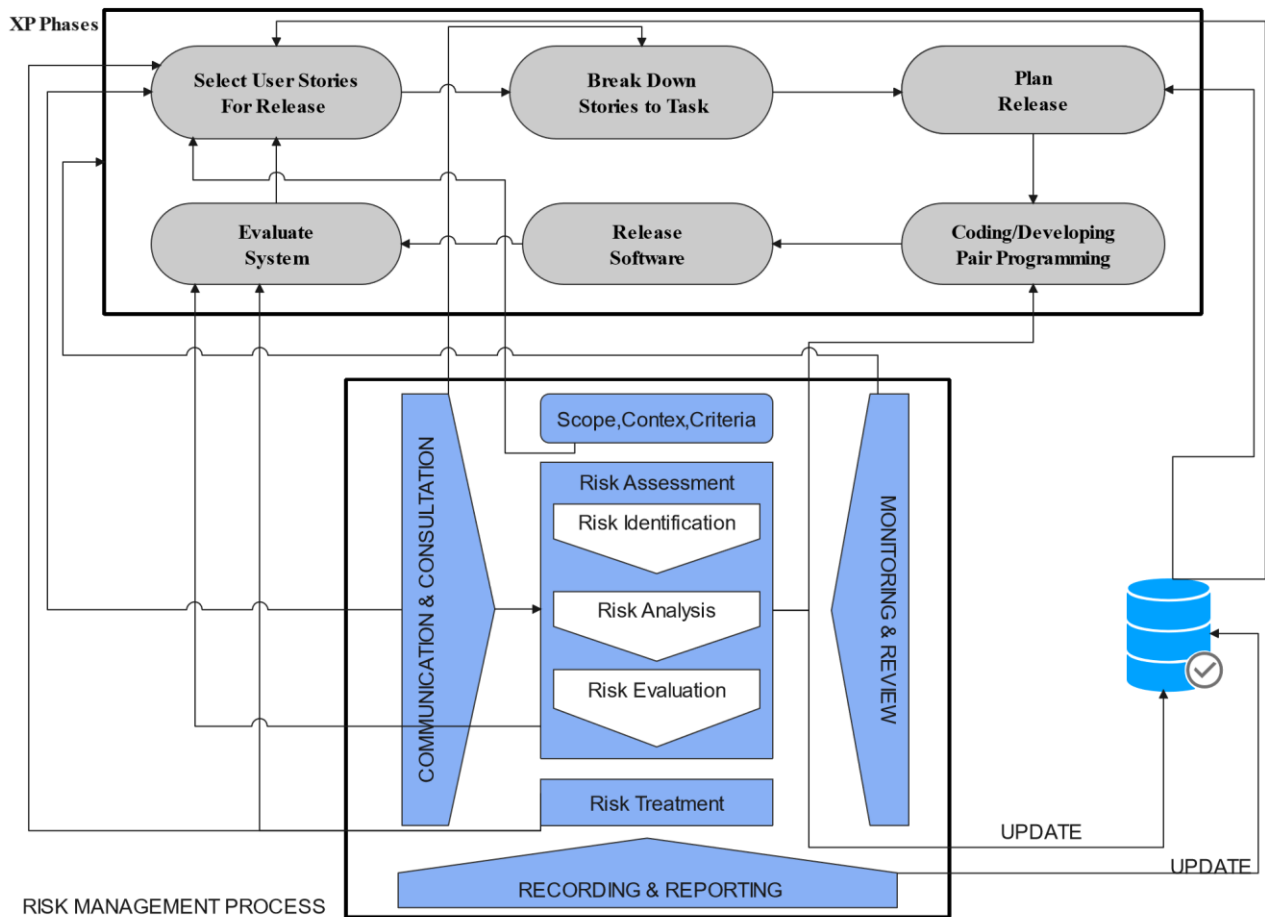— Relationships with other projects, processes and activities

Fig. 1. XP Risk Management Framework

C. Risk assessment

Risk assessment is the general process of risk identification, risk analysis and risk assessment.
Risk assessment should be done systematically, iteratively and collaboratively, using the knowledge and opinions of stakeholders. Must use the best available information, supplemented with further inquiries if necessary.

The purpose of risk identification is to identify, identify and describe the risks that may affect an organization in achieving its goals. Appropriate and up-to-date information is important in identifying risks, so the output of this step is recorded in the risk database, which must always be up to date.
The organization can use a wide range of techniques to identify uncertainties that may affect one or more goals.

The purpose of risk analysis is to understand the nature of the risk and its characteristics, including, if necessary, the level of risk. Risk analysis includes a thorough examination of uncertainty, sources of risk, consequences, probability, events, scenarios, controls, and their effectiveness. An event can have many causes and consequences and affect many goals.

Risk analysis can be performed with varying degrees of detail and complexity, depending on the purpose of the analysis, the availability and reliability of available information and resources. Analysis techniques can be qualitative, quantitative or a combination of these methods depending on the conditions and application.

The result of this section is also kept in the risk recording section for future work.

The purpose of risk assessment is to support decisions. Risk assessment involves comparing the results of risk analysis with the set criteria of risk to determine countermeasures.

D. Risk treatment

The purpose of risk management is to select and implement risk mitigation options.

Risk treatment involves an iterative process that must be performed in periodic sessions for new outputs.

E. Monitoring And Review

The purpose of monitoring is to ensure and improve the quality and effectiveness of design, implementation and process results. Continuous monitoring and periodic review of the risk management process and its results should be a planned part of the risk management process, with clearly defined responsibilities.

Monitoring and review should be done at all stages of the process. Monitoring and reviewing include planning, collecting and analyzing information, recording results, and providing feedback.

The results of monitoring and review should be included in all performance management, measurement and reporting activities of the organization.

F. Recording And Reporting

All stages of risk management and its results should be recorded and reported according to an appropriate mechanism.

Purpose of recording and reporting:

- Relationship between activities and risk management results throughout the organization;
- Providing information for decision making;
- Improving risk management activities;

Helping to interact with stakeholders, including those who have responsibilities and accountability for risk management activities.

Decisions regarding the creation, storage and use of documentary information must be considered.

IV. EVALUATION OF PROPOSED FRAMEWORK

To calculate the effectiveness of our framework, we used several experts in the field of XP by first asking them to do a project without our framework and then a series of tests that were prepared on the forms for them. Answer and then ask them to do the same project using the provided framework and then answer the tests.

We designed a test to obtain the risk response rate with and without the desired framework. We first generated descriptive statistics to examine the mean risk response score IMB SPSS Statics software that is a software package used for interactive, or batched, statistical analysis.

The phases of our practice are:
- Phase1: Participants received a questionnaire to identify their risk tolerance in XP method and risk management.
- Phase2: Participants were invited to create risk response plan for project A and B without our framework.
- Phase3: Two weeks later ask participants to plan risk response for A, B project with using our framework and then answer our test again that we can compare them.

Comparison of these tests determined the effectiveness of our framework, the result of which is shown in Table 1.

The use of our framework increased the mean risk response score by 61% for Project A and 45% for Project B.

We also looked at our framework in terms of time wasted creating a risk response program because the nature of time is the optimal and fast use of time.
Therefore, in phase 3, we also measured the time and saw that not much time is spent on this.

TABLE I. RISK RESPONSE WITH/WITHOUT FRAMEWORK

	Mean	Minimum	Maximum
Without Framework	8.5	1.7	18
With Framework	12.8	6.0	24.0

V. CONCLUSION AND FUTURE WORKS

Risk management is an important factor in project development success, it is not widely used in agile methodologies, and XP methodology has not specific processes for risk management. Therefore, there is a need to integrate explicitly risk management. This paper proposed a model activity involved in deploying risk management processes within XP framework. This model is derived based on the answers of the questionnaire respondents. The purpose of this framework is to map the principles of risk management based on the ISO31000 standard, which can increase the success rate of the project. This framework showed us that the risk response rate increases to 45% than not using framework. In future work, we will test the model and implement it in various XP software company. We also suggest model a risk management framework for agile methods in general is also becoming famous in software industry.

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