A Study on Uncertainties in Software Project Management in Pakistan

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ABSTRACT
Uncertainty is an important aspect of software projects. Usually the influence of uncertainty on a project does not come into consideration that leads to software failure. Developing software becomes difficult and complex due to tight schedules, technology, clients and uncertainty – a big reason to fail. Uncertainty could be critical for the project to be successful. Uncertainties can result from number of sources. This paper presents review on techniques and strategies followed by organizations in Pakistan to eliminate and tackle uncertainties in project, and challenges faced by organization and their consequences on projects. It is a research based on analysis of different software organizations in Pakistan to explore the challenges faced by the organization and what strategy they use to handle the uncertainty issues that arise in projects.

Keywords
Project management, Risk management, Uncertainty in software projects, Uncertainty

1. INTRODUCTION
Software Project Management deals with a lot of uncertainties but with almost each uncertainty, there is a corresponding solution or alternative scenario based on the conditions of the project, the data collected or the project’s triple constraints etc. But this uncertainty increases to a great deal when dealing with Software Project Management. The reason is that huge chunk of success or failure for the Software Projects is based on human activities and intellect, at what a human being is able to produce at a particular time, under particular circumstances. These additions of human factor in the projects makes them quiet hard to manage and generate a guaranteed outcome. No two software projects can have a guaranteed same outcome, no matter if all the underlying circumstances are same for both. But through very vigil management and planning, and with the confidence of the team in the underlying endeavors, a software project can produce excellent results within the constraints undertaken. Along with the management, there is an extra need to have better communication, having identified problems in the bud before becoming issues that affect the performance of the iterations or modules in the long run costing time and money.

In addition to this, the thing that makes a software project the most unique from a project of any other field is that software development is a creative process and thus needs to be dealt with an open mind and a creative imagination. If these aspects of a software project are considered while planning for it, the amount of uncertainties can be minimized, increasing the chances of success.

The paper is divided into the following section: Section II defines briefly about the research paper reviews relevant to the selected topic. The next Section III consists of methodology introduced in which a model is proposed explained through diagrams. The paper concludes and summarizes the main findings of study in Section IV of our research.

2. LITERATURE REVIEW
Project management provides effective solutions but it also comes with a lot of challenges. Due to which project management activities and projects have very high impact on the society. There are many factors that influence the project management activities; one of them is uncertainty in the project management. Some research has been conducted to find out the impact of uncertainties in the project management.

According to the study of Standish group [1] there are only 39% projects that are successful and are delivered to the client on time with estimated cost and the actual requirements provided by the clients. The percentage of the projects that organization fails to deliver on time is 43%. The late delivery could be due to high cost than planned, schedule overrun and some other uncertain conditions. 18% projects are rejected at the time of delivery and they are never been used by the client. The change has been seen after a decade in the activities of project management.

The main reason why project fails is the mismanagement or the misunderstanding the role of the project manager. Project manager have no idea how to handle the situation if a project encounter uncertainty [2]. Furthermore, according to the literature review of project management, authors are not commonly agreed upon what actually uncertainty is [3]. Uncertainty could be referred as absence of certainty that means missing information. Uncertainty leads to ambiguity and non-deterministic approach in project management [4]. Risk management and uncertainty in a project must have been taken into account very seriously and it must be complimentary. Project managers must focus on the strategies that can eliminate the unknown risk as well as they must have some strategic plan to handle uncertainties in the project occurs during the project development life cycle [5].

According to a study [7] uncertainty is something that cannot be identified for analysis and it is less prone to be suspected. As uncertainties are never known, this could be a threat to our project, but we have no idea that in what form the uncertainty will occur. If uncertainty has been detected earlier than we cannot call it uncertainty rather it will be analyzed as risk.
may have a feeling that we will get uncertainty but what that will be we cannot identify that. Uncertainty can only be identified when it transforms itself into a problem and at that time it may be too difficult and late to deal with the outcomes.

Some previous studies concluded that project managers must follow best practices to deal with the uncertain situations and to overcome their consequences. Some authors say that differentiated approaches must be used along with complexity integration to handle uncertainty. Pre-risk planning is not enough to handle the uncertainties occur by the limitations and constraints on the project. Especially the project domain and some specific area that is not obvious in the project. According to a study [6] there is not one single source of uncertainty but it is a very vast and volatile area. Uncertainty can come from any source it could be external source, technology source, market source etc.

2.1 Market uncertainty
Market uncertainty includes the threats that a product may encounter when it has been launched in the market. It depends on the customer response and the way you market a product. The actors in this case are customers, providers, suppliers and the current market scenario [8].

2.2 Technological uncertainty
It focuses on how much the project is prone to the technology that we are using. Technological uncertainty cannot be categorized as universal. It only rely upon the type of technology exist.

Technological uncertainty can occur due to communication gaps, technology and tools that have been used for development, project plan slipping etc. it also affects the project manager and development team technical expertise [9].

2.3 Environment uncertainty
This uncertainty occurs due to organization’s internal as well as external environment. Project manager must have a proper understanding of the organization in order to handle uncertainties that will be generated from internal or external environment [8].

2.4 Socio-Human uncertainties
The major factor of a project failure is social culture and human misunderstanding. Human management is very important factor in the life cycle of a project. And it is usually seen as ambiguous and unclear in the project management phase. To handle socio-human uncertainty project team must be very flexible and creative [10].

Social-human uncertainties involve interaction among the project team members as well as their interaction with the organization environment. It is very important to focus on religious, political and personal trainings to avoid this kind of uncertainty in the project.

This literature review motivated us to conduct a survey from different software organizations in Pakistan. Further research involved techniques and methods to deal with uncertainty in project.

3. RESEARCH METHODOLOGY
An uncertainty is one of the causes for project failure across the organization. It is a fact that many projects fail due to uncertainties and not only due to technological or other failures. To control uncertainties that occur in a project, it is necessary to know what uncertainties can occur in a project, what strategies and measures could be planned to deal with those uncertainties.

3.1 Research Planning
To get answers of above questions, we have conducted a survey different software firms in Pakistan using questionnaire technique to know about the uncertainties faced by organizations in Pakistan and how they are eliminated. In our survey, we targeted the top management staff that has knowledge about all the projects across the organization and ask them to answer variety of questions to know how often their organization faces uncertainty and do they have any planned strategies to deal with them.

3.2 Research Questions
Our survey comprised of the following research questions.

- **RQ 1:** What kind of uncertainties is faced by software organizations?
- **RQ 2:** Is it necessary to maintain the correlation with stakeholders and involving them to agree and provide feedback to incidental changes to control the uncertainties?
- **RQ 3:** Should there be any cost/budget kept reserved for uncertainty in organization’s projects?
- **RQ 4:** How often software industries consider managing uncertainties?
- **RQ 5:** Any preventive measures (techniques or strategies) that can be used to diminish uncertainties in project?
- **RQ 6:** Are the tools reliable that are used for reducing or monitoring uncertainties?
- **RQ 7:** What strategy can organization use to deal with uncertainty?

3.3 Survey Findings
We conducted a survey and got our questionnaires filled from the firms i.e. Bentley, AWT and performed an empirical analysis. The target group to fill the questionnaire was top management that includes team leads, CEOs, managers and any person who has know-how of projects that are going in an organization or past projects. Such group was targeted as they can perfectly answer the questions on which our research is based on. Top management has knowledge about the past and present projects of organization along with their experience. And such group has log of uncertainties occurred in projects throughout the projects.

The development or job career of the targeted audience is introduced briefly. Performing survey through questionnaire, we targeted 10 persons from top managerial level that include Executive IT Officer, Sr. Software Quality Analyst, CEO, Director, Sr. Server Administrator, Manager Administrator and Team Lead to gather the answers related to uncertainty that are analyzed in this section of paper.

Among all the 10 persons, 40% were qualified in Masters and the same percentage for qualification in Bachelors. 20% of them belong to the category of others that includes some diploma and certifications. As far as experience is concerned, 10% of people had experience above 15 years, 10% had 10-15 year experience, and 40% had experience of 5-10 years while 40% belong to 1-5 year category.

Now after highlighting the backgrounds of the targeted group, we will answer the research questions mentioned in the third section of the paper, in Research Methodology section.

Today, many organizations face uncertainties in their projects and that is no hidden secret anymore. Uncertainties can be
related to technology, administration, platforms, skills, processes and many more.

The (RQ 1) arise from this point and make us ask various experience people to get knowledge about what kind of uncertainties are faced in software firms of Pakistan. The uncertainties in projects that usually are faced in software organization of Pakistan are employee turnover, change in requirements, strategic orientation, low uncertainty, skills, software failure, unscheduled projects, improper testing, vague requirement analysis, improper SOPs, milestone and variations.

Table 1. List of Uncertainties faced in organizations

<table>
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<tr>
<th>Uncertainties in SPM in Pakistan</th>
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<tr>
<td>employee turnover</td>
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<td>change in requirements</td>
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<td>strategic orientation</td>
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<td>Skills</td>
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<td>Software Failure</td>
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<td>For unscheduled projects</td>
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<td>Processes</td>
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<td>Improper testing</td>
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<td>Vague requirement analysis</td>
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<td>Improper SOPs</td>
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<td>Milestones and Variation</td>
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Uncertainties that are faced in organizations are also linked with collaboration of stakeholders so they should also be involved to accept and respond to the changes that occur so that uncertainties could be controlled. Our (RQ 2) is based on the defined perspective. RQ 2 is concerned about the degree of collaboration of stakeholders necessary in projects whenever any unplanned change occurs that might lead towards uncertainty and further towards project failure if not controlled by keeping stakeholders in loop. So that stakeholders have know-how of the project. According to the survey findings, 20% say that stakeholders involvement is the most important part to get them involved and informed about changes and uncertainties, 40 people think that stakeholder’s involvement has also to be focused to face uncertainties, 20% acted neutral to the question that shows they consider about involving the stakeholders but it’s not the only remedy to deal with uncertainties while 20% disagreed with the point of view about stakeholders collaboration. This is further defined in Figure 1.

![Fig. 1 Management of relationship with stakeholders](image)

Uncertainties can arise in a project anywhere and anytime throughout the life of project development. (RQ 3) is based on view that is it necessary to keep any specifically assigned budget for uncertainty. According to the results, 50% of the software organizations usually keep some budget for uncertainties in projects, 30% never kept any budget for uncertainties. It is further shown in Figure 2.

![Fig. 2: Revising budget for uncertainties](image)

It’s obvious that uncertainties can occur in a project and it is also necessary to handle them because they may lead to project failure. For a project to be successful it is important to know that uncertainty is a risk and it should be eliminated. (RQ 4) gets the response for how often software industries in Pakistan consider managing our uncertainties. 40% organizations think that uncertainties should be tackled from 41-60% of project, 30% thinks that organizations should manage uncertainties 21-40% while 30% consider managing uncertainties to minimum level of 1-20%. The analysis is shown in Figure 3.

![Fig. 3: Software industries consider managing uncertainties](image)

As it is known that how necessary is uncertainty in a project, so uncertainties should be handled under some criteria or it can be any defined strategic plan for preventive measures to reduce uncertainties occurring in a project in an efficient way and in a timely manner. (RQ 5) is also about the techniques used by software firms in Pakistan that help reduce uncertainties. Through survey, uncertainties could be handled through proper planning and mentioning the uncertainties, by following proper requirements of project, gathering data, proper audits, by improving the estimations and always accommodating cushions in terms of time, resources and budget allocation, allocating sample resources on coaching and training of colleagues, by collaboration, implementing Pareto Principal to keep yourself away from unnecessary issues and according to some risk management is also important to handle uncertainties. Acquiring techniques and strategies in bringing down the uncertainty, and also to realize the origin of uncertainty to better handle each type of project, can help reduce uncertainties. Identify the sources of uncertainty in the project and address unexpected events as soon as possible is another measure for dealing with the uncertainty. Some organizations opt for model sensitivity analysis. Whenever you
design a solution, think of ways that can make your solution fail or collapse. And then refine your solutions. Consider both best and worst possible scenarios. Instead of demanding to make the one identify the estimates rightly as to what will most likely happen, multiple estimates should be made. Identify uncertainty issues on a various kind of options. This is the way how truly creative process works, and creation is a good analogy for prediction.

Many software organizations in Pakistan also prefer to use tools while some do not use tools due to reliability of tools and prefer to do it manually or using some analysis techniques or charts. (RQ 6) is about the reliability of the tools that are used by software organizations in Pakistan that help reduce and monitor uncertainties. According to survey, 70% organizations rely on tools to manage the uncertainties in projects and avoid project failure while 30% organizations think that tools are not reliable enough that a project can solely depend on. It is further shown in Figure 4.

**Fig. 4: Reliability of tools for uncertainty**

What are the strategies are implemented by organizations in Pakistan that help reduce uncertainties. (RQ 7) answers about the role that a software firm can use to deal with uncertainty. Through survey we came to know that organizations have proactive and clear definitions of all the uncertainties in projects. Some use methodical techniques that don’t require high accuracy and emphasize their assessment of creativities on the inputs, not just the outputs. Have a dedicated department or team of experts who are explicitly experienced in monitoring and managing the challenging situations like uncertainties, bottlenecks, deadlocks etc. and are thoroughly available to help different project teams. One of the strategies is to have a visionary in team who just focuses on ONE thing. Here are some approaches/strategies to use depending on the constraints.

- Assigning about 30% of the agenda for uncertainties to happen.
- Projects having high-uncertainty, the scope can be tuned and obligated only to the schedule as this is the only thing that can be controlled.
- In high-uncertainty projects because the scope is not known and there is no fixed agenda such as in reactive companies and departments like customer support, employees are trained to handle urgent matters quickly.

Determining the project type to select proper management and managing the assumptions of stakeholders so that they submissively accept changes. For fixed agenda and fixed scope projects, add cushion time in the schedule. This works for low-uncertainty projects, especially those that repeat the same type of work many times. Simple mathematical models are often more reliable for catering with highly complex situations than more comprehensive models. This is especially good information for marketers, who may be used to seeing awareness and favorite data with two or more decimal places. The problem in handling with social networks and other complex systems is that a sophisticated model is more likely to fit past data well but fail to foresee the future, while a more basic model is less likely to fit past data, but more likely to be able to antedate different future situations. Uncertainty is the responsibility of everyone or it could be someone specific from the organizations that have the solution for uncertainty issues in projects.

**Fig. 5: Responsibility of providing solution to uncertainty**

Hence, the more we have understanding of awareness of a particular subject the more we decrease uncertainty. The response from software forms to the same statement is shown in Figure 6.

**Fig. 6: More knowledge, less uncertainty**

4. CONCLUSION

The paper represents a study on uncertainties in software firms in Pakistan narrating their adopted preventive approaches to reduce uncertainties to avoid project failures. Uncertainty reduction is an important fragment of software projects nowadays. It could be predictable or unpredictable therefore it is necessary during planning phase to propose a strategy for uncertainty handling. A way of reducing uncertainties in projects could be focusing on three words; "THE ONE THING" - Identify it to avoid unnecessary efforts. Planning with patience and analysis are key to deal with uncertainties.
5. REFERENCES


