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SOFTWARE PROJECT MANAGEMENT : WHITE PAPER

Dr. Diksha Grover

Assistant Professor,

Rajdhani College,University of Delhi

Dr. Shweta Paradkar

Assistant Professor

Kalindi College, University of Delhi

Abstract -

Reasons of a project not meeting its objectives may or may not be under the control of an organization, but a planned project execution for sure brings down the failure possibilities or even when the risk occurs again.. Are our project managers equipped enough to handle this failure?

Many organizations are not able to answer this question correctly. A project manager's technique becomes the critical aspect to any project's success. This white paper describes those considerations in detail which will help a project manager in achieving the project targets and ensuring that it is completed within the scheduled target and the different techniques you have used when dealing with risk in your professional setting.

The Problem-

How to manage the Quality, Risks, and Frameworks for a software Project.
Different projects require different forms of risk management, even when the risk occurs again. A project manager's technique becomes the critical aspect to any project's success. Think about the different techniques you have used when dealing with risk in your professional setting. Initiation is often described as the most critical process group and planning as the most complex.

Project Management Techniques

- ***Triple Constraint***

Importance of Triple Constraint: No competition can deliver fair results without following the predefined rules and regulations, in other words "constraints". Every project has to deal with three constraints that are Scope, Time and Cost. It keeps a project to remain in the competition and deliver the quality results. These three constraints cannot be managed in isolation. These are equally influential on the final outcome of the project. Change in one will affect the other(s). It is important for us to hang these in balance to achieve the project objectives. This balancing act is an art or a skill that is called good project management.

Role of Quality in Triple Constraint: The definition of Quality is Conformance to Requirements. The super set of requirements is nothing but the project Scope (the first constraint). Conformance is nothing but the set of rules defined by a project. It says you do not have an unlimited budget (the second constraint) and an unlimited Time (the third constraint) to meet these requirements. The Triple constraint affects to the Quality of final outcome either in positive manner or negative manner. Let us discuss it one by one. Scope – When Scope is variable and Budget and Time are constant the impact is on Quality. The final outcome of the project will not be of the same quality as defined in the Project Management Plan. Time – When Time is variable and Scope and Cost are constant the impact is again on Quality. We have either more time for doing the same amount of work means we can give superior quality product or less time for doing the same amount of work means we will compromise in the quality. Cost – When cost is variable and Scope and Time are constant the impact is obviously again on quality because when you add more sugar sweeter the pudding is and vice versa. More resources always cost us more and vice versa.

Its Importance for an in-house projects centric Organizations: This is part of human psychology that we do not give importance or show seriousness towards the things that do not have any direct implication on us; hence in this situation we mess around with the things easily. It will not be a hasty generalization if we say that all in-house projects and organizations doing in-house projects are victim of this phenomenon. Triple Constraint asks us to have equilibrium among Scope, Time and Cost to achieve the required Quality results (as per the Project Management Plan). This balancing act is clearly missing from almost all in-house projects. Reason is simple we tend to believe we have unlimited Budget, unlimited Time and any point in time we can change the Scope because project is in-house. This is enough for sending the project Quality on toss. Due to lack of seriousness for Triple Constraint almost all in-house projects are missing in ROI, usability, reusability, extensibility and other important factors.

- ***Risk Management***

How would you identify the different risks and then subsequently manage them?

Risk Identification and its management is a continuous process and are followed during the entire life of project. When we identify and reduce the risks at the beginning of a project, it makes our life easier for subsequent stages of project and improves the probability of project success.

Before getting into identification of risks, if we follow some guidelines than risk identification process becomes structured. I treat project contract as a bible and PM should read it at least once in a day, may not be completely but relevant sections of it. This is the beginning point of risk identification.

Another intelligent aspect of risk identification is, to whom you involve in it. PMs generally make this mistake, due to preconceived notions, personal prejudice and lack of attention they ignore those people who really can contribute in risk identification process. PMBOK prescribe that one should involve project team, risk

management team, subject matter experts, customers, end users and stakeholders but I feel PM should be open to think beyond these people as well. In my experience: I had to move my project team in a new building across the road. Somehow I asked my support staff, how the new facility is, and one AC technician told me that centralized AC system is defective and previous team was complaining about the cooling. I listed it as a risk in my risk register and assigned it to our Admin Manager. It caused delay in the movement but team moved only when comfortable working environment was ensured.

PM should know that Dependencies = Risks. How PM manages the dependencies, tracks the due dates and assesses the quality of dependency met, will certainly add some entries in our risk register.

It is also very important to notice that people around you (specially the risk owners) will always try to convince you that what you have identified or assigned to is not a risk. PM must be very firm and should believe in his competence. Do not remove the risk or not list the risk in risk register, just because of someone has some wasted interest in not showing it there. This is one of very critical factor of risk identification.

Perfectly blended risk identification exercise may use above guidelines and following methods:

1. Interview – When we talk face to face with someone, he reveals some sensitive information and develops confidence in PM and project.
2. Brainstorming - It is a quicker way of identifying, sharing and assigning risks. If need arises PM can use Delphi technique or distribute questionnaire in the same eeting.
3. Consulting SMEs – Subject Matter Experts give an independent view of problem that generally is missing in project environment. Though it may sound time consuming but it also provides dependable solution.
4. Project Documentation – Old (Historical) documents can give us the idea about previous risks encountered for similar projects. Current documents reflect gap in procedures followed and creating problems for project team. Project checklist document allow us to find where we are missing.
5. Stakeholder Analysis – It helps in understanding the interests, attitudes and potential actions of stakeholders that can lead to some risks for project.
6. Resource plan – Who is available when and how long with what skills all that helps in identifying risks
7. Project Plan – Main source of risk identification in terms of time, scope and quality
8. Integration and Interfaces – These are two critical tasks in software projects that are potential source of risks. Interfaces can be with internal or external systems
9. Assumptions – Every failed assumption is a risk.
10. SWOT analysis – It balances out the identification of positive and negative risks
11. Diagrams – Some time PM can use flow cart or cause and effect diagram to reach on the conclusion that identified risk is surely exists.

Once risk identification is done subsequently Project Manager has to

1. Categories and classify the risks properly
2. Pick up those risks that really need analysis and do the timely analysis of the risks.
3. Make the correction in analysis and assign only the correct probability of occurrence
4. Intelligently plan mitigation, document risk responses and decide on time to spend on preparing contingency
5. Open the risk register every week in project meetings and update it then and there in terms of adding new risk, changing priority, changing or assigning owners etc.
6. Never delete the risk from risk register just mark it inactive

IT Risks Identification and resolution

IT function is a back bone of every organization. Any small hitch in it is proportional to dollars, directly or indirectly. The main IT categories where risks can happen are:

• Hardware

• Software

• IT procedures and practices

• Internal and external interfaces and connectivity

• Data criticality and sensitivity (security)

• Persons who support IT department and persons who use the infrastructure

Depending upon the environment, organization maturity and its customer base, some of the relevant risks examples are:

1. Terminated employees' system ID is not removed from the system
2. Company firewall allows inbound telnet, and guest ID is enabled on XYZ server
3. Unauthorized users (hackers etc.) has identified flaws in the security design of the system; however, new patches have not been applied to the system
4. Data center uses water sprinklers to suppress fire; tarpaulins to protect hardware an equipment from water damage are not in place

Some of the techniques defined in previous section can be used to identify the risks, for example: questionnaire, interviews, document reviews, on-site visit, automated scanning tools etc.

Similarly for above risks resolutions can be

1. Plug the gaps in exit process that ensure no such incidence happen in future
2. Review firewall set up actions and periodically review them, get audited as well
3. Plan regular system update, have checklist, and audit reports
4. Keep tarpaulins ready

- ***Project Risks***

Project Risks are events, circumstances, situations that "may" occur and affect the project plan/progress. As soon as these events become certain, they cease to be risks and should be tackled as problems. Risk management aims at ensuring risks do not become problems. It facilitates a shift from "fire fighting" and "crisis management" to proactive decision-making. Of course, it must be appreciated that risk management does not guarantee success but increases the probability of success.

Project manager should assess risks continuously and use them for decision-making in all phases of the project. They should carry the risks forward and deal with them until they are resolved or until they turn into problems and are handled as such. Each of the following elements should be addressed on a continuous basis throughout the life cycle:

- Risk Identification
- Risk Analysis
- Risk Action Planning
- Risk Control and Tracking
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Risk Identification

Each member of the project development team should be encouraged to identify and report potential risks in their focus area. Project manager should continuously share the logical outcomes of current risk strategies, plans, and activities by exercising his expert opinions and judgment to identify new risks. Newly identified risks should be discussed at weekly team meetings to determine the appropriate handling option. Risk Identification is done, typically, by using: Organizational database of risks, Brainstorming sessions, Information from past projects. The project manager should assign responsibility for addressing each potential risk.

Risk Analysis

Analysis is the process of examining the risk in detail to determine the extent of the risks, how they interrelate, and which ones are the most important. Analyzing risks has three basic activities: evaluating identified risks, classifying, and prioritizing or ranking them. Following steps are followed for the analysis and prioritization of risk in a project:

- Consolidation approach for similar risks
- Evaluate risk severity based on impact for each risk category
- Prioritize risks
- Identify top risks
- Obtain management approval

For each and every risk, a risk probability matrix should be developed that should be used to assess the likelihood of occurrence of each risk. Example

P < = 33%	The event probably will not happen OR Historical evidence, including lessons learned, suggests this to be an unlikely occurrence OR Has not happened in other organizations of similar size
33% < P <= 66%	The event has a reasonable likelihood of occurrence OR Historical evidence, including lessons learned, suggests this sometimes occurs
P > 66%	This event is very likely to occur OR Historical evidence, including lessons learned, suggests this to be a very likely occurrence OR Has happened in other organizations of similar size

For each and every risk, impact criteria matrix should be developed to define the impact on each of the categories and contribution of individual categories towards total risk exposure. Example

W<=2	Impact limited to task or activity OR Project budget overruns can be fully covered by partial use of Project funding reserves OR Unacceptable system performance degradation during peak load periods OR Software does not support some in-place desktop equipment and no upgrades are scheduled OR Significant modular functionality dependent on availability of interfaces OR Individual task completed late but Project control dates still can be met OR Performance related issues or decision making delays cause control dates and /or

	Project end date to be missed but Program/external dependencies are few or non-existent OR Minor functionality is lost due to requirements/functionality gap OR Functionality loss is acceptable; No gap closure is necessary OR Minor staff resistance encountered; no additional transition support required OR Unable to deploy new software development tool to replace the existing one OR Limited amount of functional driver benefit not met by module
2<W<=3	Project budget overruns can be fully covered by full use of available Project funding reserves OR Unacceptable system performance degradation during peak load periods OR Software does not support some in-place desktop equipment and no upgrades are scheduled OR Significant modular functionality dependent on availability of interfaces OR Project control date(s) missed, but Project end date is not slipped OR Performance related issues or decision making delays cause control date(s) and/or Project end date to be missed but there is no critical impact on external dependencies OR Significant level of functionality is lost due to requirements/functionality gap OR Unmet functionality can be accommodated by process changes OR Workarounds exist to offset loss of functionality OR Significant, additional transition support required to overcome staff resistance OR Additional software bolt-ons required to facilitate deployment OR Module achievement is substantially below expectations
3<W<=5	Project budget overruns or other negative budget events impact the project funding available for pending modules; causing a delay in initiating new modules and/or eliminating planned modules OR System performance is unsatisfactory during periods of normal operations OR System solutions incompatible with organization standards OR Overall system viability depends on availability and integrity of interfaces OR Performance related issues or decision making delays cause project end date to be missed with significant impact on external dependencies OR Loss of Executive management commitment causes significant impact on schedule strategy OR Major functionality is lost in requirements/functionality gap OR Additional software is needed to close gap and make system module viable OR No workarounds exist to alleviate major functionality loss OR New system is rejected by users OR Module fails to achieve one or more functional aspects or is substantially below expectations

By multiplying risk probability matrix and impact criteria matrix and summing them up for each category the risk exposure is determined. The highest level of severity is identified for a risk with the highest value of Risk Exposure. Example

Risk Exposure (RE)	**Risk Severity**
RE>75	High
50<RE<=75	Medium
RE<=50	Low

Risk Action Planning

Project Manager should assign each approved risk to the appropriate team member or organizational entity. All the project risks should be marked in the Risk Register. Each person or entity that is assigned a risk becomes a risk owner. For each assigned risk, the risk owner is responsible for:

- Developing a mitigation strategy as appropriate
- Developing a contingency plan as appropriate
- Obtaining the approval on above from respective management authority.
- Implementing approved mitigation strategies
- Establishing effectiveness measures
- Record/inform mitigation action taken to PM
- Periodically evaluate effectiveness of mitigation strategies and alter ineffective strategies
- Identify and carry out continuous monitoring steps

Risk Control and Tracking

The purpose of risk control and tracking is to decide what should be done about a risk or set of related risks. Take appropriate actions, assess their effectiveness, monitor mitigation strategies and contingency plans, acquire, compile and report risk status data and finally take timely, and effective decisions regarding risks. The decision making is the part of the risk strategy and there are four type of responses we can make to risks:

Avoid – The risks are dealt like that it will not come in between the project execution. We change the project plan in a way that this risk never occurs or we remove the risky module from execution or we redefine the business objective in such a way that this risk does not occur. All these kind of steps completely eliminate the possibility of risks but there is a possibility that profitability of the project can take a hit.

Transfer – It means transfer the responsibility of the risk to other person or party. There are some situations when we don't want to be responsible for failure, cost, time etc. According to the situation we pass on the buck to others, may be third party, buyer or seller. These kinds of response do not eliminate the risk from the system but you are just saved from the problem. It does not come for free, you have to pay extra cost for this transfer in terms of premium, buying insurance etc.

Mitigate – When we say we are mitigating the risk means we are reducing the probability of its occurrence and the impact of damage in the event of occurrence. This all related to proactive actions we take to save the project from disaster.

Accept - Acceptance of a risk means that the severity of the risk is low enough that we will do nothing about the risk unless it occurs. Once the risk occurs, we will fix the problem and move on. Accepting a risk does not mean that we will not do something about the risk when and if it occurs; it means that we will do something about it only if it occurs. Most of the time it happens that risk does not occur and you do not need any action.

For handling any risk following guidelines can be applicable (as per the project):

- All HIGH severity risks (Risk Exposure greater Than 75) require both a mitigation strategy and a contingency plan.
- MEDIUM severity risks (50<Risk Exposure <=75) require a contingency plan. Mitigation strategies may be required. The Project Manager can recommend that a mitigation plan be written, and may recommend a mitigation approach
- LOW (Risk Exposure<=50) severity risks typically don't require a mitigation strategy or contingency plan.
- Any different response rules can also be defined and reflected in project management plan.
- The response time frames to handle any project risks can be (as per the project):
    - Near-term – Less than 15 days

    - ***Frameworks***
    - **classify a given framework as a project life cycle, a product life cycle, or a systems development life cycle.**
    - **Common and Different Elements**

Features	Waterfall	Prototyping	Incremental
Implementation Principle	Sequential	Iterative.	Combination of sequential and iterative
Emphasis on	Planning , Schedule, Budget and Implementation	Minimization of risks and easy acceptance of changes	User acceptance and quick availability of working system

Simplicity	Simple phases and easy to implement	Simple phases but bit complex than waterfall to implement	Over all complex as defining iteration, meeting deliverable dates etc. is not that simple
Usability	For small and medium size projects where requirements are clear.	For big projects where risk is involved	For big projects where requirements are clear and quick semi working system is required
Customer involvement	Low, In the last at the time of acceptance	Heavy , as prototype is developed with customer feedback only	Heavy , as customer has working software at early stage
Change adaptability	Very difficult because it restricts to go back to previous phases	Easy because adopting customer feedback is its main characteristic	Easy because requirement clarity improves in every subsequent iteration
Available to use	After the final phase only.	After the final phase only.	After the first iteration itself with limited functionality
Requirement Clarity	Requirements are defined in the beginning of the life cycle.	Requirements are evolved and change adopted during prototype development	Requirements are defined in the beginning of the life cycle.
Architecture and Design	Architecture is available before implementation, difficult to change	Design evolves, once prototype accepted, difficult to change later	Complete design is not decided upfront, evolution leads to some rework
Testing	Difficult to test and needs lot of time as all the requirements are tested together	Easy to test because lot of unknowns are closed during prototype development itself. Less time required.	Easy because one iteration at a time is tested. Scope is focused.
Development Time	Almost fixed, variation depends on requested changes	High, because of prototype development	Less than waterfall and variation depends on requested changes
Development Cost	Almost fixed, variation depends on requested changes	High, because of prototype development	Less than waterfall and variation depends on requested changes

Conclusion-

Good project skills, process & frameworks , management of risks and the importance of quality in projects will lead to the success of the Software Projects.

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